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ALAMEDA POINT
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TABLES

FINAL OPERABLE UNIT 2B REMEDIAL INVESTIGATION REPORT SITES 3, 4, 11, AND 21

DATED 05 AUGUST 2005

TABLE 4-1: ESTIMATED VALUES OF AQUIFER HYDRAULIC PARAMETERS

Remedial Investigation Report for Sites 3, 4, 11, and 21, Alameda Point, Alameda, California

OU-2B Site	Test Method	Method of Analysis	Transmissivity (ft^2/day)	Hydraulic Conductivity (ft/day)	Storage Coefficient[a] S	Source
First Water Bearing Zone						
Site 4	soil (lab)	unknown		5.6E+00		PRC 1992
				2.2E-04		PRC 1992
Site 11	slug test	Bouwer and Rice		2.1E+00		Shaw 2003
Second Water Bearing Zone						
Site 11/21	pumping test	Hantush-Jacob	9.8E+01	4.4E+00	1.4E-03	Shaw 2003

Notes:

a	Dimensionless
ft/day	Feet per day
ft^2/min	Square feet per minute

5.0 REMEDIAL INVESTIGATION FOR SITE 3 – ABANDONED FUEL STORAGE AREA

This section describes the history and setting of Site 3 (Section 5.1), environmental investigations conducted at Site 4 (Section 5.2), the remedial investigation (RI) results (Section 5.3), and the RI conclusions and recommendations (Section 5.4). The RI results section addresses soil at Site 3 and one discrete lead groundwater plume, which is in the northern portion of the site. This section does not address the operable unit (OU)-wide groundwater plume located beneath the southern half of Site 3, in addition to other OU-2B sites. Because the OU-wide groundwater plume was formed by the convergence of groundwater plumes emanating from multiple OU-2B sites, the background, nature and extent, fate and transport, human health risk assessment (HHRA), and ecological risk assessment (ERA) for the OU-wide groundwater plume are presented in Section 9.0, so the cumulative effects of these contaminants are addressed. Section 3.0 discusses the approaches used to conduct these evaluations. Appendices E, F, and G, respectively, present the complete background comparison, HHRA, and ERA for OU-2B.

5.1 SITE 3 HISTORY AND SETTING

Site 3 is located at the eastern entrance to Alameda Point along West Atlantic Avenue and West Seaplane Lagoon Street and is bordered to the south by Site 4 (see Figure 5-1). Site 3 measures about 50 acres; is roughly rectangular; and consists of Parcels 116A, 116B, 116C, 117, 118A, 118B, 120, 122, 128, 129, 131, and 209. Site 3 is an intensively developed area and is bordered by intensively developed and paved (airfield) areas (see Figure 2-6). An area near the entrance to Alameda Point along West Atlantic Avenue is landscaped with mostly grass and a few shrubs, but approximately 80 percent of Site 3 is covered with asphalt and concrete. The site consists primarily of buildings, roads, and parking lots. Typical urban wildlife, such as the California ground squirrel, scrub jays, and American robins, have been observed in the intensively developed areas; however, they are less frequently observed in the landscaped/developed areas because less foraging habitat is available. Feral cats also are found in the intensively developed area (U.S. Department of the Navy [Navy] 1999).

Section 5.1.1 discusses the history of Site 3, including specific details about physical features and activities associated with hazardous waste generation or past disposal and storage practices, and Section 5.1.2 discusses future land use at Site 3.

5.1.1 History

Site 3 is known as the Abandoned Fuel Storage Area. In 1943 four concrete aviation gas (AVGAS) underground storage tanks (UST) (USTs 97A, 97B, 97C, 97D) were constructed in the center island along West Atlantic Avenue at the eastern entrance to Alameda Point. A fifth 10,000-gallon UST (UST 97E), constructed of steel, was built in 1962. Three of the five USTs were cleaned and closed in place in 1987 after leaks were detected in one of the USTs (UST 97A). The other two USTs (USTs 97B and 97E) were closed in place but were not cleaned. Supply Fuels Branch personnel estimate that as much as 365,000 gallons of AVGAS may have leaked into the surrounding soil and groundwater in the 1960s and early 1970s (International Technology Corporation [IT] 2001a). In addition, a nearby fuel line burst in 1972 releasing an unknown amount of AVGAS into the surrounding soil (Kennedy Engineers 1979). AVGAS has been found in utility ducts, storm drains and soil samples in and around Site 3. The southern half of Site 3 includes corrective action area (CAA)-3A, CAA-3B, and CAA 3C (Figure 5-1).

Additional features at the site include Buildings 112, 119, 337, 222, (also known as Building 512B), 512B, 517, 517A (also known as Building 220), and 527, Naval Air Station (NAS) generator accumulation point (GAP) 10; Structures 71 and 175; former bunkers; former Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, and 394; former Buildings 109, 264, 295, and 548; and former Structures 222-1 and 430. Sitewide features include underground fuel lines, storm sewers, and open space. The history and description of each of these physical features summarized below was developed based on review of various reports and historical aerial photographs.

Former Underground Storage Tanks (UST) 97A through 97E. Four 100,000-gallon, carboline-lined concrete AVGAS storage USTs, 97A through 97D, were constructed in 1943 in the center island of the site along West Atlantic Avenue at the eastern entrance to Alameda Point. A fifth 100,000-gallon steel tank, 97E, was built in 1962 for additional AVGAS storage. USTs 97A, 97C and 97D were cleaned and closed in place in 1975 after leaks were detected in UST 97A. USTs 97B and 97E were closed in place but were not cleaned.

NAS Supply Fuels Branch personnel estimate that as much as 365,000 gallons of AVGAS may have leaked from the USTs to soil and groundwater in the 1960s and early 1970s (International Technology Corporation [IT] 2001a). In addition, a nearby fuel line burst in 1972, releasing an unknown amount of AVGAS to soil (Kennedy Engineers 1979). AVGAS has been found in utility ducts, storm drains, and soil samples collected from in and around Site 3 (Engineering Resources Management-West [ERM-West] 1994).

Building 112. This 33,657-square foot (ft^2) building was constructed in 1944. The building, located in the western portion of the site, was formerly used as an aircraft support facility, and a Ship Intermediate Maintenance Activity (SIMA) painting and ship repair facility (IT 2001a). It has concrete and asphalt floors and formerly housed various operations, including a supply storeroom, weight test area, zinc smelter, carpentry shop, upholstery shop, tool issue shop, and non-destructive testing laboratory. Chemical storage was associated with hydraulic systems (hydraulic fluid), welding activities (acetylene, oxygen, and argon gases; cutting fluids; and lubricant oils), and wood finishing activities (paints, stains, varnishes, solvents, adhesives, cleaners, and various corrosive materials). The asphalt open storage space around the building is visibly degraded and dirty, with multiple paint stains (ERM-West 1994).

NAS Generator Accumulation Point (GAP) 10. NAS GAP 10 is a non-permitted RCRA GAP associated with Building 112 and the area outside the northeastern and eastern portion of Building 112 (Tetra Tech EM Inc. [Tetra Tech] 2003a). NAS GAP 10 historically was used to store solvents, waste oils, and asbestos (ERM-West 1994). According to aerial photographs of the site, NAS GAP 10 was active between 1947 and 1988. In the 1996 aerial photograph, NAS

GAP 10 appears to be nearly vacant and no longer in use as a GAP (Pacific Aerial Surveys, various years). Department of Toxic Substances Control (DTSC) recommended no further action (NFA) for this solid waste management unit (SWMU) in letter dated November 4, 1999. A Navy recommendation for NFA is included in Appendix I.

Building 119. This building was constructed in 1985 as a 4,700-ft^2 fast-food restaurant and is located in the eastern portion of the site. Chemicals historically stored and used in this building include sanitizer products, degreaser, wood finishers, patching plaster, paint, floor wax, and powdered bleach (ERM-West 1994). Prior to the construction of Building 119, the open space was used for parking (IT 2001a). The building currently functions as a coffee shop.

Building 337. This 840-ft^2 corrugated metal building was constructed in 1946 as a former chemical supply storehouse. This building is located next to Building 112 and has asphalt floors and sprinkler and ventilation systems. The building was used for SIMA hazardous materials storage (paints, adhesives, gasoline, diesel, and waste oils). Staining from paint and vehicle fluids was observed in and around the building (ERM-West 1994). Pad-mounted transformers were located east and west of Building 337 during the Phase I environment baseline survey (EBS) site inspection (ERM-West 1994). It is unknown if the transformers contained polychlorinated biphenyls (PCB).

Building 517. Building 517, the Navy Exchange Beverage Store, was built in 1968 and expanded to triple its original size sometime between 1969 and 1975. The 8,208-ft^2 store, which is in the northwestern portion of the site, was used as a garden shop for at least 25 years, storing potting soil, plant fertilizers, pesticides, and other garden supplies in moderate quantities for display and consumer purchase. The steel-framed building has concrete and tile floors (ERM-West 1994). The building is currently leased to an automobile repair shop.

Building 517A (also known as Building 220). Building 517A was built in 1972 and functioned as a 500-ft2 garden equipment storage and office space. The wooded shack, which is located in the northern portion of Site 3, has a wood floor and stored small quantities of chemicals associated with garden equipment (such as lubricating oil and gasoline) (ERM-West 1994).

Building 527. Building 527 is located near the center of the site. It was built in 1970 and was a 8,400-ft^2 credit union leased by Alameda Reuse and Redevelopment Authority (ARRA) at the time of the Phase I EBS (ERM-West 1994).

Structure 71. This structure is a mounted A-7 aircraft monument located in the landscaped center island at the eastern entrance to Alameda Point, which is in the southern portion of the site. The monument was constructed in 1987 (ERM-West 1994).

Structure 175. Structure 175 is a transformer house with a concrete floor located in the southwestern portion of Site 3. It was built in 1943 and occupies 99 ft^2. A transformer and circuit breakers were present during the Phase I EBS (ERM-West 1994).

Former Bunkers. Four bunkers, each measuring roughly 3,750 ft^2, are visible in an aerial photograph from 1957. Only a footprint is visible in the aerial photograph from 1969, and the bunkers are gone in a 1975 aerial photograph (Pacific Aerial Surveys, various years). It is unknown what these bunkers were used for or what their building numbers were.

Former Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, and 394. Very few details are available on this series of former buildings. According to the EBS, Buildings 121-1 and 122-1 are present in a 1953 aerial photograph but are absent in a 1970 photograph (ERM-West 1994); however, their exact locations are not cited in the EBS. Building 119-1 was constructed in 1944 and served as a temporary, 1,280-ft^2 torpedo store house. The 119-1 building number was later reassigned to a fast-food restaurant, Building 119 (see the discussion above). Building 394 was constructed in 1955 as a 1,475-ft^2, metal-framed, concrete-floored, pallet-repair shelter and aircraft accessory overhaul and assembly shop (ERM-West 1994).

Former Building 109. Former Building 109, a 310-ft^2 gasoline truck loading stand, was constructed between 1959 and 1969 and was located in the western portion of Site 3 (ERM-West 1994). Heavy staining is visible north of this building in a 1975 aerial photograph. The building was demolished sometime between 1975 and 1988 (Pacific Aerial Surveys, various years).

Building 222 (also known as Building 512B). This building was built in 1972 as a garden shop. This wooden structure with an asphalt floor stored and displayed resale potting soils, manure, pool supplies (chlorine and muriatic acid), and patio equipment (ERM-West 1994).

Former Structure 222-1. Former Building 222-1 was demolished in 1966 and reassigned as Structure 222-1, located between 512B and 517A (ERM-West 1994). This structure is no longer present, and its former use is unknown.

Former Building 264. This former H-shaped utility building is present in a 1988 aerial photograph but is absent in the 1996 photograph (Pacific Aerial Surveys, various years). The 7,533-ft^2 semi-permanent building was constructed in 1944 and used as an exchange service outlet. The area in the northern portion of Site 3 is currently covered with grass (ERM-West 1994).

Former Building 295. This building was a personnel weather station. The semi-permanent building was removed between 1985 and 1990, and only the concrete foundation remains (ERM-West 1994).

Former Building 548. This 576-ft^2 building was constructed in 1974 as an Exchange Snack Stand in the northwestern portion of Site 3. After the building was demolished in 1992, the area was used for parking (ERM-West 1994).

Former Structure 430. This former structure was built in 1957 and used for aircraft truck refueling. Heavy staining is visible south of this building in a 1975 aerial photograph (Pacific Aerial Surveys, various years). In 1979, the highest concentrations of fuel were detected in the vicinity of Structure 430 (Kennedy Engineers 1979). This building was demolished between 1975 and 1988 (Pacific Aerial Surveys, various years).

Fuel Lines. Fuel line removal work was conducted at Alameda Point from June 1998 to February 1999, May to June 1999, and September to December 2001. As of December 2001, all underground fuel lines had been either removed or closed in place (cleaned and grouted). The underground fuel lines associated with Site 3 have been removed (Tetra Tech 2002).

Storm Sewers. Numerous storm sewer lines are located at Site 3. Figure 5-2 shows the locations and condition of storm sewers at Site 3. The sewers flow to various outfalls, including Outfalls G and H in Seaplane Lagoon. As Figure 5-2 shows, various segments of these lines were categorized and prioritized based on their condition and whether they are located below the groundwater table (Tetra Tech 2000b). Most of the storm sewer lines at Site 3 are below the groundwater table. Storm sewer lines are considered to be possible preferential pathways for contaminants in groundwater, if they are below (or likely below) the groundwater table and exhibit sags in areas where they intersect a groundwater contaminant plume. The sags identified below indicate areas where the storm sewer appears to have settled. They do not necessarily indicate breaks in the line where groundwater could infiltrate into the storm sewer.

There is a significant sag in a sewer line that originates east of Site 3 and runs parallel to the northern site boundary. The sag starts at manhole 6H-5 and extends west approximately 170 feet. This line then continues past the western site boundary, turns south at manhole 6H-4, re-enters Site 3 130 feet south of manhole 6H-4, and then continues south past the site boundary, eventually discharging into Seaplane Lagoon through Outfall H. The line is located below the groundwater table, within the lead groundwater plume, and sags were observed (see Figure 5-2) (Tetra Tech 2000b).

Building 119 is connected to one storm sewer line that originates 130 feet east of Site 3 at catch basin 7H-2 and that flows under Building 119. Catch basins 7H-1 and 7H-1A are located within Building 119. The Building 119 line meets the line discussed above at manhole 7H. The section of line between catch basins 7H-2 and 7H-1 is likely below the groundwater table and within the OU-wide groundwater plume. The section of line between catch basin 7H-1 and manhole 7H is below the groundwater table and also within the OU-wide groundwater plume, but no sags were identified.

Building 430 is connected to a line originating at catch basin 6H-2C that flows south through catch basins 6H-2B and 6H-2A and joins the main line at manhole 6H-2. This line is below the groundwater table and within the OU-wide groundwater plume. The section between catch basins 6H-2C and 6H-2B is also located within the OU-wide groundwater plume. Another storm sewer line located at the southern end of the site originates approximately 135 feet east of Site 3 and flows southwest to manhole 6H, where it joins the main line. This entire section is located below the groundwater table and within the OU-wide groundwater plume. Three short lines branch out from this line. The easternmost branch is approximately 10 feet long and originates at catch basin 7HC. This line is likely below the groundwater table and also within the OU-wide groundwater plume. The center branch originates from catch basin 7H-4B, passes through catch basin 7H-4A, and meets the main line at 7H-4. This section is also likely below the groundwater table and likely within the OU-wide groundwater plume. The section of this line between 7H-4 and 7H-4A has a significant sag. The last branch originates at catch basin 6HB, passes through catch basin 6HA, and meets the main line. This branch is located below the groundwater table and within the OU-wide groundwater plume.

Open Space. Site 3 is 80 percent open space consisting of lawn areas, roadways, general vehicle parking lots, container storage areas, gardening supply storage areas, and vehicle parking areas specifically associated with a retail store, credit union, and restaurant. Most parking and roadway areas are paved with concrete. The paved parking areas show typical vehicle stains associated with parking spaces. In 1947, some of the northern portions of Site 3 were used as a storage area prior to being developed (ERM-West 1994).

5.1.2 Future Land Use

According to the "NAS Alameda Community Reuse Plan", Site 3 is located in the Marina District and Civic Core (see Figure 2-2). The most likely reuses for Site 3 include residential and commercial/industrial activities (EDAW 1996).

The Civic Core is planned to consist of approximately 334 acres for reuse in the central part of Alameda Point. This area currently supports a wide range of use patterns, including the central open space mall, the shoreline along Oakland Inner Harbor, and the East Gate entrance station. Residential, recreational, administrative, warehouse, and industrial structures also are located in this reuse area (Navy 1999c).

The Civic Core is planned to be developed as a mixed-use "flex zone" to accommodate a range of uses based on the near-term reuse of existing facilities, with redevelopment and in-fill changes, additions, and demolition occurring over time. Development in the mixed-use zone would emphasize international business and commerce, research and development facilities, support of commercial uses, and residential use. Potential civic uses include public recreation facilities, a museum, a library, a teen activity center, a civic auditorium, civic office space, a place of worship, and meeting spaces (Navy 1999c).

The Marina District is planned to cover about 126 acres around the entire shoreline of Seaplane Lagoon. The Navy used this reuse area primarily for deepwater ship and seaplane berthing, and equipment storage and repair. A proposed open space promenade extending from the Civic Core would open into a civic plaza as it meets the water's edge in the area. A hotel and conference center would be built on 4 acres. Civic uses, such as office space, a cultural arts center or theater, and recreational areas, could front the plaza. Housing in the area would be limited to the eastern shore of the Seaplane Lagoon and would provide opportunities for a mix of housing types and income levels. Housing could include artists' lofts, apartments for low- to moderate-income families, and townhouses consistent with Measure A and the City Charter (Navy 1999c).

5.2 SITE 3 ENVIRONMENTAL INVESTIGATIONS

This section describes each environmental investigation conducted at Site 3 under the Installation Restoration (IR) Program, which include investigations conducted under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the EBS, and the Total Petroleum Hydrocarbons (TPH) Program. No data were collected under the Resource Conservation and Recovery Act (RCRA) Program. Tables 5-1 and 5-2 summarize the soil and soil gas and groundwater samples collected by investigation and the types of analyses conducted. Sampling locations are shown on Figures 5-3 and 5-4 and are categorized by investigation. Results for each of the investigations are summarized in Tables 5-3 through 5-16. The summaries are organized according to medium and analytical group and include the following information: (1) the number and percent of detections of chemicals; (2) the average, minimum, and maximum detected concentrations; (3) minimum and maximum detection limits for nondetected samples; and (4) whether the maximum detected concentrations or detection limits exceed Region 9 residential preliminary remediation goals (PRG) or California-modified PRGs (U.S. Environmental Protection Agency [EPA] 2002). PRGs and maximum contaminant levels (MCL) are provided in the tables for comparison purposes only.

The following sections summarize investigations conducted at Site 3 under CERCLA, the EBS, and the TPH Program.

5.2.1 Comprehensive Environmental Response, Compensation, and Liability Act Investigations

Investigations conducted at Site 3 in conformance with CERCLA include the Phases 1 and 2A investigation, follow-on investigations in 1994 and 1998, supplemental RI data gaps sampling, basewide groundwater monitoring, and a basewide polynuclear aromatic hydrocarbon (PAH) investigation. Each investigation is summarized below. Sampling and monitoring well locations are shown on Figures 5-3 and 5-4.

Phases 1 and 2A Investigation, 1991. The purpose of this investigation was to determine the full extent of AVGAS migration into soil and groundwater from leaks in the five USTs and associated pipelines at Site 3. Contaminants expected included PCBs, pesticides, and herbicides from historical site use. The investigation included collection of soil and groundwater samples, installation of groundwater monitoring wells, and groundwater monitoring (PRC Environmental Management, Inc. [PRC] and Montgomery Watson [MW] 1993). Eleven soil samples were collected from each of three soil borings (sampling locations MW97-1 through MW97-3) (see Figure 5-3 and Table 5-1).

Groundwater monitoring wells MW97-1 through MW97-3 were constructed in the three soil borings (Canonie 1989, 1990), and one groundwater sample was collected from each well (PRC and MW 1993) (see Figure 5-3). See Table 5-2 for a list of analyses conducted.

According to the data summary report (PRC and MW 1993), volatile organic compounds (VOC), methylene chloride, acetone, toluene, and carbon disulfide were detected at low concentrations in soil samples. Additionally, total recoverable petroleum hydrocarbons (TRPH) were detected in soil samples collected in the fill and Merritt Sands. Pyrene and benzo(g,h,i)perylene were the only two PAH compounds detected in one soil sample from 10.5 to 11 feet below ground surface (bgs). Additionally, concentrations of semivolatile organic compounds (SVOC) were extremely low in soil at Site 3.

Thirteen metals, with magnesium and copper exceeding their 1996 residential PRGs, were detected in various soil samples. Magnesium was present in three samples collected from two soil borings, and copper was present in one soil sample from 7.0 to 7.5 feet bgs (PRC and James M. Montgomery [JMM] 1993).

VOCs and TRPH were detected in soil samples collected from both fill and Merritt Sand in three monitoring wells. TRPH was also detected in surface soil samples from borings in the central portion of Site 3 and in the saturated zone north of Site 3. Overall, SVOCs and VOCs were detected at low concentrations. However, TRPH was detected at concentrations above the preliminary comparison level of 100 milligrams per kilogram (mg/kg) in two soil samples (PRC and MW 1993).

Metals were detected in the groundwater at concentrations exceeding background concentrations at Site 3. VOCs and SVOCs were not detected in groundwater at Site 3; however, analytical results for soil and soil gas suggested that groundwater at Site 3 is potentially affected by these chemicals. As a result, additional monitoring was recommended to characterize the groundwater quality at Site 3.

Follow-on Investigation, 1994. This investigation evaluated the presence of TPH and related compounds in soil and groundwater at Site 3. Monitoring wells were installed to obtain additional soil data in the vadose zone and groundwater quality data for the RI and feasibility study (FS). Field activities included performing cone penetrometer tests (CPT), sampling groundwater by direct-push, installing shallow soil borings and monitoring wells, installing deep monitoring wells, performing quarterly sampling of groundwater and storm drain sediment (PRC and MW 1995a).

CPTs were performed to evaluate lithology and hydrogeologic characteristics below 15 feet bgs and to identify the shallow water-bearing zone (SWBZ). Five CPT points, CPT-S03-01 through CPT-S03-05, were tested at Site 3 (see Figure 5-3). No soil samples were collected during the CPTs; however, four direct-push groundwater samples were collected approximately 5 feet away from each CPT location in the SWBZ (DHP-S03-01, DHP-S03-02, DHP-S03-04, and DHP-S03-05). Samples were analyzed for VOCs (including benzene, toluene, ethylbenzene, and xylene [BTEX]), TPH, metals, and general chemical characteristics (including total dissolved solids [TDS], total organic carbon [TOC], and chemical oxygen demand [COD]) (PRC and MW 1995a) (see Table 5-2).

Five shallow monitoring wells (M03-04 through M03-08) were installed to further characterize the extent of TPH in the SWBZ. Monitoring wells M03-05 and M03-06 are not included in the groundwater summary in Table 5-2 for Site 3 and are not shown not on Figure 5-3 because these points are no longer within the Site 3 boundary, which has changed since this investigation. Well D03-01 was installed northwest of the center island to assess the deep groundwater flow gradient. From October 1994 to August 1995, quarterly groundwater sampling was conducted at wells D03-01, M03-04 through M03-07, M03-08, MW97-1, MW97-2, and MW97-3 (PRC and MW 1995a).

Soil sampling was conducted at one of the CPT locations (CPT-S03-01) and at one sampling location (03GB017) to assist in placement of the additional monitoring wells mentioned above. Soil samples were also collected during the construction of monitoring wells M03-04, M03-07, and M03-08 (PRC and MW 1995a) (see Table 5-1).

According to the data summary report (PRC and MW 1995a), analytes detected at Site 3 are similar in nature to those detected during previous investigations. VOCs and TPH were detected in two soil samples collected at Site 3. Additionally, it was concluded that TPH as extractables (TPH-E) was detected in 11 of 19 soil samples, with the highest concentration of TPH-E as motor oil collected east of Site 3. Solvent-related compounds were detected in the first water-bearing zone FWBZ and petroleum hydrocarbon-related VOCs and TPH as purgeables (TPH-P) were detected in the SWBZ.

Storm Sewer Removal, 1997. This removal action was conducted to address elevated concentrations of organic and inorganic chemicals in sediments and debris within the storm sewer system. The Navy Public Works Center (PWC) removed sediments and debris within the catch basins and manholes of the storm sewer system using a vacuum (Phase I of the removal action), and IT removed sediments and debris in the storm sewer system lines and associated manholes (Phase II of the removal action). Following the removal action, closed-circuit television (CCTV) was used to survey the cleaned lines. Site-specific objectives of this removal action were to reduce the potential for sediments and debris in the storm sewer system, which contain elevated concentrations of VOCs, SVOCs, pesticides, heavy metals, and fuel-related hydrocarbons, from affecting nearby human populations, animals, the food chain, drinking water supplies, and sensitive ecosystems.

Site 3 contains storm sewer lines that are part of Subsystems B, BA, BB, H, HA, HB, and J. Results of a quality control review of these subsystems were from dry weather sampling at appropriate manholes, catch basins, and outfalls in September of 1996 and April 1997. VOCs, BTEX, SVOCs, and TPH were detected at Site 3 (Tetra Tech 2000d). According to the summary report, benzene, xylenes, TPH compounds, toluene, and ethylbenzene were detected at two manholes (6H and 6H-2) during storm water sampling.

According to the summary report (Tetra Tech 2000d), Site 3 did not have any low or high priority storm sewer lines. Sections 6H to 7H-4 were characterized as nonpriority lines, which was in good condition and needed no further action (Tetra Tech 2000d).

Follow-on Investigation, 1998. This investigation further characterized groundwater plumes, monitored plume movement, and provided input to and modeled the effects of natural degradation processes through quarterly groundwater sampling and a tidal influence study. Four quarters of groundwater monitoring and sampling were conducted during this investigation. Samples were collected each quarter from monitoring wells M03-04 and M03-07. Samples collected from these wells were analyzed for VOCs, metals, TPH, and general chemistry parameters (Table 5-2). Samples collected from M03-04 and M03-07 were also analyzed for TPH. In addition, samples collected during the first quarter were analyzed for TOC (Tetra Tech 1997c).

To further evaluate the extent of chlorinated solvent plumes that covered multiple sites at OU-2B, several groundwater samples were collected using direct-push techniques. Twenty-three groundwater samples were collected at depths ranging from 7.5 to 45 feet bgs from 5 locations within the Site 3 boundary (Tetra Tech 1998c) (see Figure 5-3). See Tables 5-2 for a list of samples and analyses performed.

Sampling results indicated that a petroleum hydrocarbon plume was migrating radially from the center of Site 3. Monitoring wells were located along the margin of the plume to the east, northwest, and southwest of the center of Site 3. Sampling of these wells revealed the presence of petroleum hydrocarbons and associated VOCs. The analytes encountered are associated with both AVGAS from Site 3 and VOCs originating from Site 4, which borders Site 3 to the south.

The tidal influence study was conducted over 24 hours and included 23 wells. Five wells were located in the southeast corner of Alameda Point, and one deep well (D03-01) was associated with Site 3. Monitoring well D03-01 (screened from 49.5 to 59.5 feet bgs) had a water level fluctuation of approximately 0.4 foot over the 24-hour study period (Tetra Tech 1997a). One deep monitoring well (D11-01), approximately 600 feet southwest of Site 3, was also monitored. Monitoring well D11-01 (screened from 50 to 60 feet bgs) had the largest tidal fluctuation in the southeast portion of NAS Alameda, with a 1.1-foot change in elevation during the 24-hour study period (Tetra Tech 1997a). This monitoring well is approximately 585 feet from Seaplane Lagoon and had an estimated lag time for tidal response of 1 hour.

According to the investigation summary (Tetra Tech 1997c), concentrations of one or more organic compounds (acetone, BTEX, diesel, gasoline, motor oil, and TPH) exceeded their respective MCLs in groundwater samples collected during all four quarters. Arsenic, barium, cadmium, chromium, cobalt, lead, manganese, molybdenum, nickel, selenium, vanadium, and zinc were also detected (Tetra Tech 1997c).

See Table 5-2 for a list of analyses conducted and Figure 5-3 for sampling locations.

Supplemental Remedial Investigation Data Gaps Sampling, 2001. The specific objectives of data gaps sampling at Site 3 were to (1) delineate chlorinated VOCs plumes in groundwater, and (2) collect soil gas samples to support vapor intrusion modeling in the HHRA (Tetra Tech 2001d, 2002). As the data for Site 3 were evaluated, it became apparent that characterization of the lateral limits of the groundwater contamination plumes was insufficient.

Subsequently, the Navy implemented the data gaps sampling program in 2001 and 2002. Results of previous soil and groundwater sampling conducted during the EBS indicated elevated concentrations of lead at two locations in Site 3. One of the main objectives of data gaps sampling was to further delineate lead in soil and groundwater detected during the EBS sampling at Site 3. To evaluate the extent of lead in soil and groundwater, 53 soil samples and 40 groundwater samples were collected using direct-push techniques (see Figure 5-3). Twelve soil gas samples were also collected to support vapor intrusion modeling in the HHRA. Samples collected in the northern portion of Site 3 near the garden shop area were analyzed for metals and organic lead because no other compounds were detected above PRGs in samples collected during the EBS (see Figure 5-3). Other samples collected around the former USTs area using direct-push were analyzed for VOCs and TPH. Nine groundwater samples collected from monitoring wells were analyzed for VOCs, TPH, SVOCs, and PAHs (Tetra Tech 2002). Sampling locations are presented on Figure 5-3, and Tables 5-1 and 5-2 list the soil and groundwater samples and analyses performed.

Results of the groundwater investigation indicated TPH was located northwest of Site 3 (Tetra Tech 2002). The lateral and vertical boundaries of the VOC and TPH plumes were defined to MCLs or other groundwater screening levels, except for one location north of Site 3. One step-out sample was recommended at this location. Because TPH plumes are commingled with the chlorinated VOCs, TPH will be managed under the CERCA Program.

No storm sewer investigations were conducted within Site 3 during this investigation.

Basewide Investigation of Transformer Pads, 2001. The Navy conducted a basewide investigation to identify transformers with PCB concentrations greater than 50 parts per million (ppm) for replacement. Wipe samples were collected around stained transformers, and no transformers were found in Site 3 to contain PCBs that warranted further action (Innovative Technical Solutions, Inc. 2002).

Dense Nonaqueous-Phase Liquid (DNAPL) Removal Action, 2002. This investigation was conducted to evaluate the possibility of reducing DNAPL concentrations within seven groundwater contaminant plumes (IT 2002). Two pilot tests were performed and data collected to support the pilot studies was used in the OU-2B RI report. A plume is located northwest of Building 360, with the northernmost portion of the plume on the southern border of Site 3. Only one (sampling location S04-4-3) of the two groundwater samples collected at Site 3 (sample location S04-4-3) exhibited chemical concentrations exceeding the decision criteria used to evaluate the presence or absence of DNAPL. Removal actions have been suspended because of unfavorable results during pilot studies. The pilot studies found that insitu chemical oxidation was not effective in removing the chlorinated solvent contamination.

Basewide Groundwater Monitoring, 2002. Six monitoring wells (398-MW4, D03-01, M03-04, M03-07, M03-09, and MW97-3) were sampled in June, July, September, and December 2002 and April 2003 (Shaw Environmental & Infrastructure, Inc [Shaw] 2003a) (see Figure 5-3). See Table 5-2 for a list of analyses conducted.

According to the groundwater monitoring report, one or more chemical concentrations exceeded MCLs in most of the monitoring wells during all four quarters of monitoring (Shaw 2003b, c,d,e). The chemicals that exceeded their respective MCLs included trichloroethene (TCE) 1,1-dichloroethane (DCA), 1,1-dichloroethene (DCE), vinyl chloride, 1,2-DCE (cis), 1,2-DCE (trans), 1,4-dichlorobenzene, benzene, total TPH, aluminum, arsenic, selenium, lead, thallium, nickel and chromium (Shaw 2003b, c,d,e).

Based on the data for the summer monitoring event, VOCs and TPH were present at concentrations exceeding MCLs in various locations in the FWBZ. Aluminum and selenium were detected in groundwater in the FWBZ and SWBZ (Shaw 2003b).

Fall monitoring event results indicated VOCs were present in the FWBZ. TCE, DCE, cis-1,2-DCE, and vinyl chloride were detected in the upper zone of the Merritt Sand located west and downgradient of Building 360. VOCs were not detected at concentrations exceeding MCLs in wells installed in the "upper sandy zone" along the eastern perimeter of the site (Shaw 2003c).

Winter monitoring event results concluded that the distribution of TCE in the upper fine-grained zone of the Merritt Sand is similar in distribution between the summer and winter investigations of 2002 (Shaw 2003d). When compared to the winter data, TCE concentrations in various wells have fluctuated. Groundwater elevations from the wells show a general increase in groundwater elevations between the winter 2002 and the spring 2003 sampling events. Since the fall 2002 sampling event, 1,1-DCE concentrations varied in response to water levels.

Chemicals detected during the spring 2003 monitoring event included TCE, 1,1-DCA, 1,1-DCE, vinyl chloride, 1,2-DCE, trans-1,2-DCE, 1,4-dichlorobenzene, and benzene (Shaw 2003e). These chemicals exceeded their respective MCLs in samples from various wells. Since the fall 2002 sampling event, 1,1-DCE concentrations varied in response to water level fluctuations in well M03-10.

Basewide PAH Investigation, 2003. During this investigation, PAH data were collected to calculate exposure point concentrations (EPC) for risk assessments at CERCLA sites. Historical PAH data collected at each CERCLA site were used to estimate the mean and standard deviation of benzo(a)pyrene (B[a]P) concentrations to identify the appropriate number of samples to collect at each site. At Site 3, 52 soil borings were advanced using direct-push sample methods. Samples were collected separately from 0 to 0.5, 0.5 to 2, 2 to 4, and 4 to 8 feet bgs (Bechtel Corporation [Bechtel] 2003) (see Figure 5-3).

According to the technical memorandum (Bechtel 2002), PAHs (expressed as B[a]P equivalents) were detected at concentrations below the 2002 residential soil PRG of 62 micrograms per kilogram (µg/kg) in 83 percent of the samples, and concentrations were less than 620 µg/kg in 99 percent of the samples (Bechtel 2002). Data quality was determined to be adequate.

During sampling, high concentrations of VOCs were detected in air; these concentrations are likely associated with Area 97, which formerly encompassed five partially buried tanks for storage of AVGAS. In 1986, the tanks and associated fuel pipelines were drained, cleaned, and demolished to below the ground surface. At least 365,000 gallons of AVGAS are suspected to have leaked from one or more of these tanks between 1960 and 1978.

5.2.2 Environmental Baseline Survey Investigations

Site 3 lies within Zones 17 and 21 and is composed of EBS Parcels 116, 118, 120, 122, 128, 129, 131, and 209 (see Figure 5-1). As a part of the EBS, these parcels were investigated under the Phase 1, 2A, 2B, and 2C investigations and a storm sewer investigation (IT 2001a). An EBS is a fence-to-fence environmental survey of an installation to collect data and document current environmental conditions. Each EBS-related investigation is discussed below. Sampling locations can be found on Figure 5-4.

Phase 1. The primary objectives of this phase were to identify the Community Environmental Response Facilitation Act (CERFA)-eligible parcels and to classify parcels into area types in accordance with the "Base Realignment and Closure [BRAC] Cleanup Plan." Based on this evaluation, Parcels 116, 118, 120, 122, 128, 129, and 209 were designated as BRAC Area Type 7, which indicates "areas that are unevaluated or that require further action." Parcels classified in this category have data gaps that require additional inspection, site history investigation, and/or sampling. Parcel 131 was designated as BRAC Area Type 6, which includes "areas of known contamination where required response actions have not yet been implemented" (ERM-West 1994). Based on these BRAC designations, Site 3 was included in the Phases 2A and 2B EBS.

Phases 2A, 2B, and 2C. Soil and groundwater samples were collected and analyzed in 1995 under these phases of the EBS to fulfill the recommendations made during Phase 1 of the EBS (IT 2001a). To evaluate soil, 71 samples were collected from the surface to a depth of 11 feet bgs using direct-push techniques (see Figure 5-4). Soil samples were analyzed for metals, TPH, SVOCs, VOCs, pesticides, herbicides, PCBs, general chemistry, oil and grease, and organic lead (see Table 5-1). To evaluate groundwater, seven groundwater samples were collected from 8 to 12 feet bgs using direct-push techniques. Groundwater samples collected using direct-push techniques were analyzed for various analytes including metals, SVOCs, VOCs, and pesticides (ERM-West 1994) (see Table 5-2).

Metal concentrations detected in soil and groundwater samples were generally within background concentrations and below PRGs except for arsenic, mercury, lead, beryllium, copper and zinc, which were detected in various parcels throughout the investigations. In particular, soil samples collected near Buildings 517 (Parcel 116) and 222 (Parcel 118) exhibited concentrations of arsenic, mercury, and lead exceeding 1996 PRGs. Additionally, lead concentrations in one groundwater sample collected at Parcel 118 (sample location 118-0012) exceeded the 1996 PRG (IT 2001). Soil samples collected from Parcel 122 (Building 112) exhibited arsenic, beryllium, copper, and zinc at concentrations that exceeded the 1996 PRGs. Concentrations of lead in soil samples from Parcel 129 were similar to Alameda Point background concentrations except for one soil sample with lead concentrations exceeding the 1996 PRG. One groundwater sample

(sample location 129-0018) exhibited concentrations of 15 metals exceeding their respective 1996 PRGs.

Results of the first phase concluded that additional investigation was necessary for Parcels 116 and 118. One direct-push groundwater sample and one duplicate were collected from Parcel 118 and analyzed for VOCs and dissolved metals. Chloroethane was present in groundwater samples collected from Parcel 118 (Building 222).

During all three investigations five SVOCs (B[a]P, benzo(b)fluoranthene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd]pyrene) were detected at concentrations exceeding 1996 PRGs in soil samples at Parcel 116 (Building 517) (IT 2001).

Pesticides detected in soil samples at Parcel 120 (Building 119) included Aroclor-1260, alpha-chlordane, gamma-chlordane, chlordane, and 4,4'-dichlorodiphenyltrichloroethane (DDT). It was concluded that due to the relatively low concentrations detected no further investigation was necessary for pesticides in this area.

Parcel 128, located south of Building 112, had one sample of TPH quantified as gasoline exceeding the respective TPH criterion. All other TPH compounds were below the TPH criteria for diesel and motor oil.

Storm Sewer Investigation. A storm sewer investigation was conducted at the same time as the Phase 2A and 2B sampling activities (IT 2001a). This investigation was designed to address contaminants in the storm sewers. Ten soil samples were collected from five storm sewer sampling locations (127-SS-001, 127-SS-003, 127-SS-004, 131-SS-001, and 131-SS-002) (see Figure 5-4). The samples were analyzed for organic lead, oil and grease, pesticides, SVOCs, VOCs, TPH, and metals (see Table 5-1).

According to the EBS investigation report (IT), analytes were detected in samples from Parcels 129 and 131 only. The work plan for storm sewer sampling did not require the collection of samples from Parcels 116, 118, 120, 122, 128, and 209 (IT 1994).

B(a)P was detected at concentrations exceeding 1996 PRGs in samples from the storm sewer corridor at Parcel 129. Nickel and zinc were detected at concentrations below their PRGs but above background concentrations. Pesticides, PCBs, organic lead, VOCs, and TPH were not detected in soil samples collected at Parcel 129.

B(a)P, benzo(b)flouranthene, and indeno (1,2,3-cd)pyrene were detected at concentrations above 1996 PRGs in samples from the storm sewer corridor at Parcel 131. The VOCs benzene, ethylbenzene, and xylene were detected in soil samples, with benzene concentrations exceeding the 1996 PRG. Oil and grease were detected in two soil samples, and there were no detectable concentrations of pesticides, PCBs, organic lead, or TPH (IT 2001).

5.2.3 Total Petroleum Hydrocarbon Program Investigations

After Alameda Point was identified for closure in September 1993, the TPH Program was implemented to decommission all USTs. As part of the program at Site 3, TPH investigations were conducted between 1995 and 2000 and a treatability study was conducted. TPH related investigations were conducted (1) in the vicinity of former USTs 398-1 and 398-2, (2) in the vicinity of former USTs 97-A through 97-E, and (3) during a fuel line removal in 1998 (Figure 5-1). During these investigations, direct-push soil and groundwater samples were collected, monitoring wells were installed and sampled, and vacuum excavation soil and groundwater samples were collected along former fuel lines (see Tables 5-1 and 5-2). Sampling also was conducted at Site 3 within CAA 3B (Building 109) and CAA 3C.

An intrinsic bioremediation study was conducted at Site 3. Results of this study indicated that in situ natural bioremediation of contaminants (mainly AVGAS) is occurring, but only in soil that is not covered by pavement or concrete. Areas of known AVGAS contamination that are covered with pavement contain free product. Free product is no longer present in the area of Site 3 covered by grass because of natural bioremediation (BERC 1998). There are no current removal actions or pilot studies for TPH underway at Site 3.

5.2.4 Resource Conservation Recovery Act Investigations

A RCRA facility assessment (RFA) was conducted at Alameda Point in 1992 to identify SWMUs and areas of concern (AOC) and to evaluate the need and scope of a RCRA facility investigation (RFI). NAS GAP 10 was identified in the RFA (DTSC 1992) as a non-permitted GAP and was evaluated during the Phase 1 EBS (ERM-West 1994). DTSC recommended NFA for NAS GAP 10 (DTSC 1999). A Navy recommendation for NFA is included in Appendix I.

5.3 SITE 3 REMEDIAL INVESTIGATION RESULTS

This section presents the results of the investigations conducted at Site 3 in support of the CERCLA risk management process. Evaluations conducted at Site 3 included (1) a site-specific CSM, (2) a data quality assessment, (3) a background comparison, (4) a nature and extent evaluation, (5) a fate and transport evaluation, (6) an HHRA, and (7) an ERA. Sections 5.3.1 through 5.3.7 summarize the results of these evaluations. Appendices E, F, and G, respectively, present the complete background comparison, HHRA, and ERA.

5.3.1 Site-Specific Conceptual Site Model

The conceptual site model (CSM) for Site 3 was used to support the nature and extent evaluations and risk assessments by identifying potential sources of contamination, media affected, exposure pathways, and future receptors. Figure 5-5 presents the CSM for Site 3. The groundwater pathways discussed in Figure 5-5 refer only to the Site 3 lead in groundwater plume.

Through environmental investigations and literature searches, physical features or activities at Site 3 that might have generated hazardous waste or released chemicals to the environment were identified. The following Site 3 physical features and activities were identified as potential sources of contamination:

- Building 112 and NAS GAP 10 (zinc smelter, overhaul and repair aircraft support facility) – hydraulic fluid, cutting fluids, lubricant oils, paints, stains, varnishes, solvents, adhesives, cleaners, various corrosive materials, waste oils, and asbestos
- Building 119 (restaurant) – sanitizer products, degreaser, wood finisher, patching plaster, paint, floor wax, and powdered bleach
- Building 337 (chemical supply storehouse) – paints, adhesives, gasoline, diesel, PCBs, and waste oils
- Buildings 222, 517 and 517A (garden shop) - pool supplies, plant fertilizers, pesticides, and other garden supplies
- Former Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, and 394 – unknown chemical use
- Former Building 109, Former Structure 430, USTs 97-A through 97-E, and associated fuel lines (fuel delivery system) – petroleum and related compounds (such as BTEX)
- Landscaped open areas around Site 3 – pesticides and PCBs

Of these potential sources, former Structure 430, use of pesticide and PCB-containing oils for dust and weed control, and USTs 97-A through 97-E and associated fuel lines were identified as likely sources of soil and groundwater contamination at the site.

Exposure pathways and primary and secondary release mechanisms may include the following:

- Direct release of oils containing PCBs (Aroclor-1260), lubricants, and petroleum hydrocarbons (benzene, PAHs, and TPH) or other hazardous wastes to soil from leaking USTs and associated fuel lines, and spills near Structure 430
- Secondary release from soil to air through volatilization or resuspension of particulates
- Secondary release from soil to homegrown produce
- Secondary release from soil into the food chain from plant uptake
- Secondary release from soil to groundwater through infiltration (see Section 9.0)

- Direct release to groundwater from leaking USTs or fuel lines (see Section 9.0)

- Secondary release from storm sewers to surface water (see Section 9.0)

As Figure 5-2 shows, storm sewer lines at Site 3 were categorized as follows: (1) above the groundwater table, (2) likely above the groundwater table, (3) below the groundwater table, or (4) likely below the groundwater table (Tetra Tech 2000b). Some of those storm sewer lines are considered to be possible preferential pathways for contaminants in groundwater, because they were identified as being below (or likely below) the groundwater table and as exhibiting sags in areas where they intersect a groundwater contaminant plume (see Section 9.0).

As the CSM for Site 3 shows (see Figure 5-5), residential, commercial/industrial, and construction worker receptors were identified as potential human receptors, and exposure pathways include ingestion, inhalation, and dermal contact with soil and groundwater and inhalation of ambient and indoor air. Direct contact with soil and the food chain also were identified as complete terrestrial ecological exposure pathways. In addition, exposure of marine ecological receptors to contaminants through groundwater discharged to the Seaplane Lagoon was identified as a complete ecological exposure pathway and is discussed in Section 9.0.

5.3.2 Data Quality Assessment

As discussed in Section 5.2.1, investigations were conducted at Site 3 under CERCLA, the EBS, and the TPH Program in order to identify and assess the extent of contamination in soil and groundwater and to determine risk. Data were collected over a period of approximately 10 years using a biased and phased sampling approach. Sampling focused on the objectives below.

- Identify the full extent of AVGAS migration into soil and groundwater from leaks in the five USTs and associated pipelines at Site 3.

- Evaluate the extent of chlorinated solvent plumes that cover multiple sites at OU-2B.

- Evaluate the extent of cadmium, chromium, cyanide, and lead contamination in soil and groundwater at two plating shops.

- Evaluate fill material and native sediments to determine if PAHs are present in soil and sediment.

Detection limits for some of the data used to evaluate Site 3 exceeded the 2002 residential PRGs (EPA 2002). These elevated detection limits are from one or more of the following circumstances: (1) the evolution of lower detection limits as technology improves, (2) the revision of PRGs over time (which are not always technologically feasible), (3) and matrix interference. The first two of these circumstances generally do not result in significantly elevated detection limits. However, matrix interferences sometimes cause significant elevations in the detection limits for a chemical, which leads to uncertainty as to whether that undetected chemical could be present in significant concentrations at a site. Although some detection limits (sample quantitation limits) were elevated above 2002 PRGs, detection limits for nondetected chemicals were sufficiently low to permit identification of potential health risks.

Because detection limits for SVOCs in soil were elevated, further sampling and analysis of soil may be necessary to confirm these chemicals are not present in soil at Site 3. Although soil data gaps were identified, it was determined that the types and numbers of samples collected at Site 3 (see Figures 5-6 through 5-12) and the analyses conducted (see Tables 5-17 and 5-19) were sufficient to characterize soil at Site 3 and conduct risk assessments because data collection focused mainly on potential sources and was conducted in phases. The phased approach afforded stakeholders opportunities to provide feedback on the suitability or adequacy of the data and the need to collect additional data to identify releases and complete the RI report. There is a low potential of any source at the site not being adequately evaluated or of recommending NFA if it poses a potential risk to human health or the environment.

Both definitive and screening-level data were generated. Screening data were considered appropriate for use in only nature and extent and fate and transport evaluations. See Section 3.4.2 for further detail regarding determining data quality and the use of definitive and screening-level data. In general, definitive quality data are consistent with EPA Analytical Level III, as specified in EPA's "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA 1988a), and samples were analyzed in accordance with Contract Laboratory Program (CLP) methods. Because laboratory detection limits for older PAH data were elevated and the 2003 PAH data were collected to replace older data, only PAH data from the 2003 sampling event were used in this RI. Data qualified "R" were also excluded from use in this RI.

Data generated during the environmental investigations that were considered to be of sufficient quality for use in the RI are presented in Appendix D. Two individual groundwater contaminant plumes were identified for OU-2B, an OU-wide groundwater plume and a lead groundwater plume located in the northern portion of Site 3. Groundwater data from Site 3 and the other OU-2B sites pertaining to the OU-wide groundwater plume are discussed in Section 9.0, while the lead groundwater plume is addressed in this section.

Tables 5-17 through 5-19, summarize the CERCLA, EBS, and TPH investigation results for soil, the lead groundwater contaminant plume that is present at Site 3, and soil gas. The summaries are organized according to analytical group and include the following information: (1) the number and percent of detections of chemicals; (2) the average, minimum, and maximum detected concentrations; (3) minimum and maximum detection limits for nondetected samples; and (4) whether the maximum detected concentrations or detection limits exceed Region 9 residential PRGs or California-modified PRGs (EPA 2002). PRGs and MCLs are provided in the tables for comparison purposes only.

5.3.2.1 Soil

At Site 3, soil samples collected under the environmental investigations were analyzed for VOCs, SVOCs, PAHs, TPH, pesticides, PCBs, metals, and general chemistry parameters (see

Table 5-1). Of the samples collected and analyzed, 76 VOC and 67 SVOC results were considered acceptable for use in this RI. Thirty sample results for pesticides and PCBs and 117 sample results for metals were considered acceptable. From the additional PAH sampling conducted in 2003, 206 sample results were considered acceptable for use in this RI. Due to raised detection limits, PAH data for soil samples collected during previous investigations were not evaluated.

Laboratory detection limits for other chemicals in soil exceeded 2002 residential PRGs (EPA 2002) and are noted in Table 5-17. Detection limits for a few nondetected chemicals were elevated above residential 2002 PRGs (EPA 2002); however, most detection limits were below PRGs. Therefore, detection limits were sufficiently low to identify potential health risks except for the following nondetected SVOCs, for which more than 50 percent of the detection limits exceeded 2002 PRGs in soil: 2-nitroaniline, benzidine, bis(2-cholorethyl)ether, hexachlorobenzene, n-nitroso-di-n-propylamine, n-nitrosodimethylamine. Because all data for these SVOCs are nondetected, they were not evaluated in the risk assessments.

A subset of the soil data were selected for use in the risk assessments. Data were considered to be appropriate for use if they (1) are validated and (2) reflect current site conditions. Data for soils that are no longer present at the sites because of removal actions were not included because they do not reflect current conditions at the Site 3. Risk from TPH was assessed separately (see Appendix H).

Soil data for each site were aggregated in depth intervals of 0 to 2, 0 to 4, and 0 to 8 feet bgs. The depth intervals evaluate potential exposures associated with site use. The 0-to-2- and 0-to-8-foot bgs depth intervals evaluate potential human health exposures, and the 0- to 4-foot bgs depth interval evaluates potential ecological exposures. The total number of samples for each analytical group included in the data set for each depth interval is summarized in the table below.

Summary of Site 3 Soil Data for Risk Assessment

Analytical Group	0 to 2 Feet bgs	0 to 4 Feet bgs	0 to 8 Feet bgs
VOCs	5	18	46
SVOCs	22	37	58
PAHs	104	156	206
Pesticides and PCBs	14	24	28
Metals	27	54	99

Although minimal data (five samples) were available for VOCs in soil from 0 to 2 feet bgs, this is not perceived as a data gap because Site 3 is paved and it is unlikely that VOCs spilled on the pavement would infiltrate into the ground. Instead they would be more likely to run into the storm drains and volatilize from the pavement. Data for 2 to 8 feet bgs are sufficient to capture the nature and extent and risk from VOCs at Site 3.

Pesticide and PCB data collected during the EBS investigations did not indicate widespread or elevated concentrations; therefore, the presence of these compounds was not a focus of this RI.

5.3.2.2 Groundwater

The lead groundwater contaminant plume at Site 3 was characterized and assessed for risk separately from the OU-wide groundwater contaminant plumef. A subset of the Site 3 groundwater data, which consists of 14 groundwater samples, was selected for these evaluations (see Table 5-18). This subset was selected to only contain sample locations within the plume This provided a conservative bias for the calculation of the exposure point concentration. Data were considered to be appropriate for use in the risk assessments if they were (1) validated, (2) representative of the groundwater contaminant plume, and (3) representative of current site conditions. Detection limits for the six nondetected samples were below residential 2002 PRGs (EPA 2002).

5.3.2.3 Soil Gas

Soil gas data were collected to evaluate risk in the HHRA from indoor air. At Site 3, 12 soil gas samples were collected at depths ranging from 0.5 to 7.0 feet bgs. Soil gas samples were collected near the maximum concentrations of VOCs detected in groundwater (see Table 5-1). Detection limits for some of the nondetected chemicals exceeded ambient air PRGs; however, sample quantitation limits were not set to meet these requirements.

5.3.3 Background

A background comparison was conducted for Site 3 by comparing a background data set with analytical results for metals in samples representative of the site. This comparison was used to identify which metals in soil are statistically similar to background and whether the concentrations could either be naturally occurring (background) or potentially resulting from historical site activities. The complete approach is presented in Appendix E and summarized in Section 3.4.3.

Based on a comparison of the data for soils at Site 3 with the background data set for the Fill Area 1 (pink area) (Figure 3-3), the following metals in soil at Site 3 are not attributed to background.

- Aluminum
- Barium
- Cobalt
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Potassium
- Sodium
- Vanadium
- Zinc

A background comparison also was conducted for OU-wide groundwater (see Section 9.2.2). The maximum detected concentration of lead in groundwater at Site 3 (210 micrograms per liter [µg/L]) exceeds the highest concentration detected in the background groundwater data set (2.9 µg/L).

5.3.4 Nature and Extent

The main objectives of the nature and extent evaluation were to (1) present the types and concentrations of detected chemicals exceeding screening levels, (2) characterize the types and concentrations of chemicals that were used by the Navy, and (3) describe the spatial distribution and concentration patterns of all chemicals that demonstrate significant risk to human health or the environment (referred to as "risk drivers"). Risk drivers are defined by the risk assessments, which were conducted prior to this nature and extent evaluation (see Appendices F and G), as those chemicals that pose a carcinogenic risk above 1E-06, an HI above 1, or pose potential risk to ecological receptors. The results of the nature and extent evaluation for Site 3 soil and the lead groundwater plume are presented below.

5.3.4.1 Chemicals Exceeding Screening Levels

The purpose of this evaluation is to provide an initial screening of chemical concentrations detected in soil and groundwater at Site 3. Concentrations of chemicals detected in Site 3 soil were compared to screening levels, which consisted of 0.62 mg/kg for PAHs (expressed as B[a]P equivalents) (Navy 2001b) and Region 9 residential or California-modified PRGs for all other chemicals (EPA 2002). No 2002 tap water PRG was available for lead in groundwater (EPA 2002), so the lead groundwater plume was not evaluated further as a part of this initial screening evaluation. Further evaluations were conducted as a part of the nature and extent of risk drivers, which is presented in Section 5.3.4.3.

Sampling locations for chemicals with concentrations exceeding screening levels in one or more sample are presented on Figures 5-13 through 5-15 and 5-17 through 5-20. Chemicals are grouped by analytical group, and sampling locations with concentrations exceeding these screening levels are designated. These figures were used to assess whether concentration patterns are present for each chemical detected above screening levels.

The table below identifies chemicals in soil that exceeded screening levels in one or more samples at Site 3. The table is organized according to analytical group and includes the maximum detected concentrations and the number of detected concentrations exceeding screening levels.

Chemicals in Site 3 Soil Exceeding Screening Levels

Analytical Group Chemical	Location of Maximum Detection	Maximum Detected Concentration	Screening Level	Number of Detected Concentrations Exceeding Screening Levels/Total Analyzed
VOCs (µg/kg)				
Benzene	131-SS-001	12,000	600	4/76
Ethylbenzene	M03-04	50,000	8,900	3/76
Metals (mg/kg)				
Arsenic	116-Z21-004	31.5	0.39	35/61
Iron	S03-DGS-DP15	44,000	23,000	18/61
Lead	S03-DGS-DP15	13,700	150	18/117
Mercury	097-002	52.5	23	1/52
PCBs (µg/kg)				
Aroclor-1260	118-Z21-003	5,200	220	1/30
PAHs (mg/kg)				
B(a)P equivalents	C3S003B002	19.1	0.62	9/206

No SVOCs or pesticides in Site 3 soil exceeded screening levels. The following conclusions were made for VOCs, metals, PCBs, and PAHs with concentrations exceeding screening levels in Site 3 soil.

Concentrations of the benzene and ethylbenzene were elevated above screening levels and appear to be localized in the western portion of Site 3. Elevated benzene concentrations occur near catch basins 3G-1B and 6H-2A and to the northwest of former Building 430 at well M03-04. Elevated ethylbenzene concentrations occur near catch basin 3G-1B and to the northwest of former Building 420 at well M03-04 (see Figure 5-13). Elevated concentrations of benzene and ethylbenzene most likely resulted from releases of petroleum products, which were used extensively at Site 3.

Concentrations of the arsenic, iron, lead, and mercury in soil at Site 3 were elevated above screening levels and exhibited no distinguishable patterns (see Figure 5-14). Elevated concentrations of arsenic and iron in soil appear to be uniformly distributed across Site 3 and are unrelated to storm sewers, buildings, or other site features, which suggests that arsenic and iron occur randomly across the site with no apparent source and may be naturally occurring. Elevated concentrations of lead are localized in the northern portion of Site 3, north of Building 517, and along the eastern edge of the site. Lead in soil in the northern portion of Site 3 may have been released to soil by the storm sewer line. Lead along the southeastern edge of Site 3 is represented by one location (well M03-07). Elevated concentrations of mercury are also represented by one sampling location (097-002), which is near the center of Site 3.

Concentrations of the Aroclor-1260 in Site 3 soil exceeded screening levels in samples from location 118-Z21-003 and appear to be confined to a small area north of Building 517A (see Figure 5-15). This building was formerly used for garden equipment storage and office space. The elevated concentration of Aroclor-1260 may be attributed to the mixing of PCBs with oil for use as an extender for pesticides in the garden shop. Aroclor-1260 was also historically used for weed control.

Elevated concentrations of PAHs, expressed as B(a)P equivalents, in Site 3 soil appear to be localized in the northeastern portion of Site 3 and in the southern portion of the site near former USTs 97-A through 97-E (see Figure 5-21). The maximum concentration was detected in a sample from 4 to 8 feet bgs in the northeastern portion of Site 3 in an area where marsh crust is known to be present. Elevated concentrations in the southern portion of Site 3 may be attributed to petroleum contamination.

5.3.4.2 Characterizing Chemicals Used by the Navy

The purpose of this evaluation is to provide additional information to determine whether contamination hot spots or data gaps are present at Site 3. This section focuses on chemicals detected in soil and groundwater that were used historically at Site 3. Most of the chemicals detected across Site 3 are consistent with the historical activities that occurred at the site, which includes the operation of a retail garden shop, landscaping/pest management, and petroleum usage. However, lead detected in Site 3 groundwater was not linked to a specific historical site use. Chemicals believed to have been used at Site 3 included pesticides, fertilizers, PCBs, and petroleum products. The concentrations of these chemicals and a general description of their extent are presented in the paragraphs below by media. Statistical summaries of all soil, groundwater, and soil gas results are presented in Tables 5-17 through 5-19.

Even though TPH is not a CERCLA contaminant, soil and groundwater were sampled at various locations across Site 3 for TPH, which includes all TPH fractions (TPH as diesel, gasoline, jet fuel, or motor oil) and TPH-associated constituents (BTEX and lead). An evaluation of TPH in soil and groundwater at Site 3 was conducted based on the TPH strategy for Alameda Point to assess contamination and possible risk at the site (see Appendix H). Analytical results for soil and groundwater samples associated with Site 3 were screened against site-specific preliminary remediation criteria to evaluate the potential risk to human health and ecological receptors from TPH-related constituents using guidance for low-risk fuel site closure (California Regional Water Quality Control Board 1996). On the basis of this evaluation, NFA is recommended for Site 3 soil and further action is recommended for Site 3 groundwater for TPH-associated constituents. TPH-impacted groundwater is addressed further in the OU-wide groundwater section (see Section 9.0). TPH-impacted soil is also discussed below, and TPH sampling locations for soil are presented on Figure 5-12.

Soil

The table below lists the detected chemicals believed to be used at Site 3, the range of concentrations detected in soil at the site, the detection frequency, and the sampling location of the maximum concentration detected. Figure 5-16 shows the locations of the samples with maximum concentrations.

Soil Analytical Results for Chemicals Believed to Have Been Used at Site 3				
Analytical Group Chemical	**Detection Frequency**	**Range of Detections (μg/kg)**	**Location of Maximum Detection**	**Sampling Interval (feet bgs)**
VOCs				
1,2,4-Trimethylbenzene	2/9	2.4 to 4,000	097-001	9 to 10
1,3,5-Trimethylbenzene	1/9	2,500	097-001	9 to 10
2-Butanone	1/63	240	M03-07	2.5 to 3.5
2,4-Dimethylphenol	1/66	43	131-SS-001	3 to 4
4-Methyl-2-pentanone	4/57	4 to 15,000	097-001	9 to 10
Benzene[1]	11/76	2 to 12,000	131-SS-001	3 to 4
Ethylbenzene[1]	18/76	11 to 50,000	M03-04	2.5 to 3.5
Isopropylbenzene	2/9	3 to 18,000	097-001	9 to 10
Methylene chloride	4/66	32 to 94	129-002-006	4 to 5
Toluene	23/76	2 to 210,000	M03-04	2.5 to 3.5
M,P-Xylene	3/9	32 to 4,000	131-SS-001	3 to 4
O-Xylene	3/20	6.9 to 4,000	131-SS-001	3 to 4
Xylenes (total)	15/67	2 to 250,000	M03-04	2.5 to 3.5
PCBs				
Aroclor-1260	6/30	9.5 to 5,200	118-Z21-003	0.5 to 1
Pesticides				
Alpha-chlordane	1/21	1.9	120-Z21-001	0 to 0.5
Chlordane	1/7	180	120-Z21-001	0 to 0.5
4,4'-DDT	2/28	7.4 to 15	120-Z21-001	0 to 0.5
Gamma-BHC (lindane)	1/28	1.9	116-Z21-004	3 to 4
Gamma-chlordane	1/21	2	120-Z21-001	0 to 0.5
Metals				
Zinc	88/91	13,000 to 1,260,000	M03-07	2.5 to 3.5
Petroleum Hydrocarbons				
TPH-diesel	40/92	2,000 to 380,000	M03-04	2.5 to 3.5
TPH-gasoline	39/90	300 to 19,700,000	M03-04	2.5 to 3.5
TPH-motor oil	48/81	24,000 to 3,700,000	M03-04	2.5 to 3.5

1 Exceeded screening levels in one or more samples. Other chemicals exceeded screening levels, but were not believed to be used at Site 3; these chemicals include arsenic, iron, lead, mercury, and PAHs.

Two principal areas of Site 3 appear to contain CERCLA chemicals in soil: (1) south of former Building 264 and (2) in the vicinity of the refueling facilities and USTs. The pesticides 4,4'-DDT, alpha-chlordane, gamma-chlordane, and chlordane were detected at Site 3 in one surface soil sample collected from location 120-Z21-001 in a landscaped area south of former Building 264 (Figure 5-16). The highest concentration of 4,4'-DDT was detected in a sample from location 120-Z21-001, and 4,4-DDT was also detected in a surface soil sample from location 120-Z21-002, northeast of 120-Z21-001 near Building 264 (Figure 5-16). Aroclor-1260 was detected in one sample at a concentration of 39 µg/kg, which was nondetected for all other PCBs. The presence of these chemicals is possibly related to the historical use of oil containing PCBs and pesticides for dust and weed control on landscaped areas around Building 264.

Numerous VOCs (1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 2-butanone, 4-metyl-2-pentanone, acetone, benzene, ethylbenzene, hexane, isopropylbenzene, m,p-xylene, methylene chloride, MTBE, o-xylene, toluene, and total xylene) were detected at elevated concentrations in soil samples collected from around the refueling facilities in the southern portion of Site 3 (see Figure 5-16). The presence of these compounds likely is related to historical releases of petroleum products from these facilities in this portion of Site 3.

Aroclor-1260 was detected in soil samples collected at Site 3 in five surface sampling locations (116-Z21-002, 118-Z21-003, 118-Z21-004, 120-Z21-001, and 120-Z21-002) in the central portion of Site 3 near former Building 264 (locations 120-Z21-001 and 120Z21-002). Three of these locations (116-Z21-002, 118-Z21-003, 118-Z21-004) are in the northern portion of Site 3 near Buildings 517A and 517, which were used for garden equipment storage (see Figure 5-16). Detected concentrations in this area range from 5,200 µg/kg (the maximum concentration detected at the site) to 9.5 µg/kg. Aroclor-1260 was also detected in two surface soil samples collected at locations 120-Z21-001 and 120-Z21-002 near the southern end of Building 264 (exchange service outlet). No transformers with documented use of Aroclor-1260 are located in these areas. Oils containing PCBs were used historically at Alameda Point for dust and weed control.

Although a zinc smelter was reported to have operated in Building 112, the maximum concentration of zinc was detected in a soil sample collected from well M03-07, along the eastern edge of Site 3 (see Figure 5-16). Concentrations of zinc in soil samples collected around Building 112 ranged from 18.2 to 118 mg/kg.

Potential sources of petroleum hydrocarbons, which include all TPH and TPH-associated constituents, in soil include former Structure 430 (aircraft truck refueling structure) and former Building 109 (gasoline truck loading stand); USTs 97A, 97B, 97C, 97D, and 97E in corrective action area (CAA)-3C; and former fuel lines in CAA-3B and CAA-3C. The maximum concentrations of total TPH in soil was detected northwest of former Structure 430 (aircraft truck refueling structure) at a depth of 2.5 to 3.5 feet bgs (sampling location M03-04). Total TPH concentrations range from 1.0 to 19,700 mg/kg. The maximum concentration of TPH-related benzene in soil (12 mg/kg) was collected at a depth of 3 to 4 feet bgs from location 131-SS-001, which is located near former USTs 97-B and 97-C and the fuel line system in CAA-3C. Most TPH-related detections of lead in soil were in samples from locations near the former fuel line in

CAA-3C; these lead detections ranged from 1.4 to 68.2 mg/kg. However, the maximum detection of TPH-related lead in soil (2,380 mg/kg) was in a sample from sampling location M03-07 on the eastern boundary of Site 3 in an area with no known fueling activities (see Figure 5-12); this samples was collected from a depth of 2.5 to 3.5 feet bgs.

Groundwater

Chemicals detected in soil discussed above were not detected in direct-push groundwater samples collected in the northern area of Site 3 where lead is present in the groundwater. Chemicals detected in groundwater in the larger OU-wide plume are presented in Section 9.0 of this report. The presence of lead in groundwater is evaluated in the following section.

5.3.4.3 Characterizing Risk Drivers

Following the evaluations of chemicals that exceeded screening levels and chemicals used by the Navy, a more detailed evaluation was conducted for those chemicals that pose potential significant risk (or risk drivers). Risk drivers were not limited to those chemicals used by the Navy; selection of risk drivers was defined by the HHRA and ERA (see Sections 3.4.6 and 3.4.7). Risk drivers are defined as those chemicals that pose a cancer risk above 1E-06, a hazard index (HI) above 1, or pose potential risk to ecological receptors. Background comparison results (see Section 3.4.3) were used to identify risk drivers attributed to background, and these drivers attributed to background were not evaluated further.

Based on the HHRA, arsenic, Aroclor-1260, benzene, iron, lead, and PAHs (benzo[a]anthracene, B[a]P, benzo[b]fluoranthene, and dibenzo[a,h]anthracene) in soil and lead in the lead groundwater plume were identified as risk drivers. Based on the ERA, lead and PAHs in soil were identified as risk drivers. According to the background comparison, arsenic is attributed to background, so it is not evaluated further.

The discussions below focus on the nature and extent of Aroclor-1260, benzene, iron, lead, and PAHs in soil and lead in groundwater at Site 3. The evaluation of these chemicals primarily includes (1) site-specific figures to assess the spatial distribution and concentration patterns of the chemicals and (2) a review of the figures, data, and site hydrology to identify the boundaries of contamination, the volume of the affected media, and, if possible, the suspected source(s) of these chemicals. Table 5-20 summarizes the nature and extent evaluation.

Aroclor-1260 in Soil

Figure 5-17 shows the concentrations of Aroclor-1260 in soil at Site 3. Concentrations of Aroclor-1260 above the screening level (220 µg/kg) are limited to surface soil samples from location 118-Z21-003 (5,200 µg/kg) in the northern portion of Site 3, north of Building 517A (garden equipment storage).

Three surface soil samples from 0.5 to 1.0 feet bgs in the vicinity of location 118-Z21-003 and around Buildings 517A and 517 exhibited Aroclor-1260 concentrations below the screening level. Aroclor-1260 was also detected below the screening level in surface soil samples from locations 120-Z21-001 and 120-Z21-002 (0.0 to 0.5 feet bgs) around former Building 264 (exchange service outlet).

No PCBs were detected near Structure 175, a transformer house, located in the southwestern portion of Site 3.

Although no spills of materials containing Aroclor-1260 were documented at Site 3, oils containing PCBs were used as an extender for pesticides around the site and were likely mixed in the garden shops (Buildings 517 and 517A). Aroclor-1260 in Site 3 soil likely is related to the use of oils containing PCBs to control weeds and minimize dust.

Benzene in Soil

Figure 5-18 shows the concentrations of benzene in soil. The maximum detected concentration of benzene (12,000 μg/kg) was detected in a sample from location 131-SS-001, which is located approximately 30 feet east of a fuel line, at a depth of 3 to 4 feet bgs. Benzene concentrations also exceeded the risk-based screening level of 600 μg/kg in samples collected from three other sampling locations, 127-SS-004, 398-1-MOJ, and M03-04. Samples were collected from locations 127-SS-004 and 131-SS-001 as part of the EBS storm sewer investigation and are not considered to be representative of current soil conditions because storm sewers were cleaned and inspected by the Navy.

Sampling location 398-1-MOJ is located in CAA-3A near a fuel line, and soil was collected at a depth of 6 feet bgs at this location during the 1998 fuel line and UST investigation. Benzene was detected at a concentration of 900 μg/kg. Soil samples were only collected at depth at locations surrounding sampling location 398-1-MOJ, so the extent of benzene is not vertically defined.

Sampling location M03-04 is located in CAA-3B, and benzene was detected at a concentration of 7,500 μg/kg in a soil sample collected from this location at a depth of 2.5 to 3.5 feet bgs. All other samples collected from sampling location M03-04 at depths between 1 to 11 feet bgs were nondetected.

Benzene is present in aircraft and vehicle fuel used throughout Site 3. Documented releases from fuel lines, USTs, and refueling facilities are the most likely source of benzene in soil at Site 3. Benzene in soil appears to be confined to a depth of 2.5 to 3.5 feet bgs near sampling location M03-04, and the extent of benzene is not vertically defined near sampling location 398-1-MOJ.

Iron in Soil

Figure 5-19 shows the concentrations of iron in soil at Site 3. Iron is naturally occurring in soil, and ambient concentrations of soil in the pink background data set range from 4,500 to

27,900 mg/kg. The maximum concentration (44,000 mg/kg) of iron was detected in a sample collected between 9.0 and 10.0 feet bgs at sampling location 097-007, which is located in the southeastern portion of Site 3. Most soil samples with iron concentrations exceeding the screening level (27,900 mg/kg) were located below the artificial fill. Concentrations of iron exceeding the screening level appear to be uniformly distributed across Site 3 and unrelated to storm sewers, buildings, or other site features, which suggests that iron occurs randomly across the site with no apparent source and may be naturally occurring.

Lead in Soil

Figure 5-20 shows the concentrations of lead in soil at Site 3. Elevated concentrations of lead are localized in the northern portion of Site 3, north of Building 517, and along the eastern edge of the site. The maximum concentration of lead (13,700 mg/kg) was detected north of Building 517 at S03-DGS-DP15 at 6 to 6.5 feet bgs. Sampling location S03-DGS-DP15 is located near a storm sewer catch basin (6H-5A), which is connected to a sanitary sewer line at Building 517. Multiple soil samples from 0.5 to 6.5 feet bgs near location S03-DGS-DP15 and also near the storm sewer line exhibited lead at concentrations exceeding the background screening level (165 mg/kg). It is unknown if the storm sewer line in this area is in contact with groundwater, but a significant sag is located directly west of manhole 6H-5. The storm sewer study did not identify any breaks or potential infiltration in this section of the line (Tetra Tech 2000b). There is no information to suggest that the storm sewer is the source of the lead in soil or groundwater.

Elevated lead concentrations (2,380 and 1,600 mg/kg, respectively) are also present along the eastern edge of Site 3 near locations M03-07 (at 2.5 to 3.5 feet bgs) and 129-001-002 (at 4 to 4.5 feet bgs). However, lead concentrations in the same borings at higher and lower depths and in nearby borings were either detected at concentrations below the screening level or were nondetected. The source for the elevated lead concentrations detected in soil in this area is unknown and remains as a data gap for Site 3.

Polynuclear Aromatic Hydrocarbons in Soil

Figure 5-21 shows the concentrations of PAHs in soil, which are expressed as B(a)P equivalents. Samples from nine locations exhibited PAHs at concentrations exceeding the screening level of 0.62 mg/kg for B(a)P. These sampling locations include C3S003B002 and C3S003B018 in the northwest portion of Site 3 and C3S003B032, C3S003B041, C3S003B043, C3S003B049, C3S003B050, C3S003B057, and C3S003B058 around the former USTs in the southern portion of the site.

A sample from location C3S003B002, located in the northwest portion of Site 3, exhibited the maximum PAH concentration at Site 3 of 19.1 mg/kg at a depth of 4 to 8 feet bgs. PAHs were detected in soil from the other sampling location in this area (sampling location C3S003B018) at a concentration of 0.88 mg/kg at a depth of 4 to 8 feet bgs. Both these locations are in an area where soil contains marsh crust (see Section 2.3.2).

Elevated PAH concentrations at depths of less than 4 feet bgs around the former USTs likely are related to petroleum releases that occurred from the USTs or from activities related to the refueling of aircraft trucks.

Lead in Groundwater

Figure 5-22 shows the concentrations of lead in groundwater at Site 3. Lead exceeded the screening level of 28.4 µg/L in groundwater samples from a well in the northern portion of Site 3 and from a well M03-04 associated with the OU-wide groundwater plume. The maximum concentration (210 µg/L) of lead was observed at direct-push sampling location S03-DGS-DP14, which is in the northern portion of Site 3. A lead groundwater plume extends approximately 200 feet north to south (see Figure 5-22) and is near elevated lead concentrations in soil (see Figure 5-20). Groundwater data from the data gaps and EBS investigations were collected to a maximum depth of 8 feet bgs for filtered (dissolved metals) samples and a maximum depth of 12 feet bgs for non-filtered (total metals) samples. The vertical extent of elevated lead concentrations in this groundwater plume is unknown.

The source of lead in groundwater in this area is unknown and is identified as a data gap. Elevated concentrations of lead in soil due to background exist directly above the groundwater plume. A storm sewer catch basin (6H-5A) and manhole (6H-5) are also located in this area (Figure 5-22). Although the storm sewer investigation identified significant sag directly west of the manhole 6H-5, it did not recommend any corrective action for this section of line (Tetra Tech 2000b).

Well M03-04 has been sampled 10 times from 1994 to 2002. Concentrations of lead in groundwater have exceeded the screening level of 28.4 µg/L only twice: once in June 1995 at a concentration of 30.9 µg/L, and once in June 2002 at a concentration of 58 µg/L. The variation in concentrations is likely due to seasonal variability. Elevated concentrations of lead were not detected in soil samples from well M03-04; however, there is a plume of free product petroleum near former Structure 430. It is possible that this plume of petroleum hydrocarbons may be influencing concentrations of lead in groundwater at well M03-04.

5.3.5 Fate and Transport

The objective of this evaluation is to assess whether risk drivers at Site 3 (1) have migrated or degraded, (2) are being released from a continuing source of contamination, and (3) are likely to be transported through groundwater or other potential pathways. The evaluation of these contaminants primarily included the following objectives.

- Identify soil sampling locations with the maximum concentrations of these contaminants.
- Evaluate the effect of groundwater flow or other potential pathways on the distribution of the contaminants.

The following sections present the fate and transport evaluation for each risk driver (Aroclor-1260, benzene, iron, lead, and PAHs in soil and lead in groundwater) to human and ecological receptors at Site 3. Because the site is currently paved, it is unlikely that sufficient soil would be exposed to transport chemicals in soil via wind. Therefore, this pathway is not evaluated.

5.3.5.1 Aroclor-1260 in Soil

As previously discussed, Aroclor-1260 was detected in surface soil samples from three locations (116-Z21-002, 118-Z21-003, and 118-Z21-004) within the northern portion of Site 3 at a depth of 0.0 to 0.5 feet bgs. Elevated concentrations (5,200 µg/kg) of Aroclor-1260 are limited to surface samples from location 118-Z21-003, north of Building 517A.

Aroclor-1260 is a recalcitrant chemical and does not breakdown readily in soil. It readily binds to organic matter in soil and is relatively insoluble in water (Agency for Toxic Substances and Disease Registry [ATSDR] 2000). It is unlikely that Aroclor-1260 will migrate to groundwater at Site 3 because of its vertical distribution (detected only in surface soils), low potential for migration, and strong tendency to bind to soil.

5.3.5.2 Benzene in Soil

Benzene in soil at Site 3 appears to be related to fuel releases and is confined to a depth of 2.5 to 3.5 feet bgs near sampling location M03-04 and near sampling location 398-1-MOJ at concentrations ranging from 900 to 7,500 µg/kg.

Benzene is slightly soluble in water, highly volatile, and biodegrades in soil under aerobic conditions (ATSDR 1997). It is likely that benzene in soil migrated to groundwater at Site 3 because of historical releases, the proximity of former fuel lines and storm sewers to shallow groundwater, and the solubility of benzene.

5.3.5.3 Iron in Soil

Iron in soil at Site 3 is uniformly distributed across the site, with elevated concentrations generally detected below the artificial fill. The maximum concentration (44,000 mg/kg) of iron was detected in a sample from location 097-007 in the southeastern portion of the site, east of the fuel line, at a depth between 9.0 and 10.0 feet bgs.

Iron occurs naturally in soil and is relatively immobile under most soil conditions because it readily forms oxides. Iron can migrate from soil to groundwater primarily under acidic and reducing conditions as solubility increases with decreasing pH (Lindsay 1979). The pH of soil samples collected at Site 3 ranged from 6.6 to 9.4. The geochemical conditions at Site 3 will tend to stabilize iron in soil and make it unlikely that iron will migrate to groundwater.

5.3.5.4 *Lead in Soil*

Elevated concentrations of lead are localized in the northern portion of Site 3, north of Building 517, at depths from 0.5 to 6.5 feet bgs and along the eastern edge of the site from 4 to 4.5 feet bgs. The maximum concentration (13,700 mg/kg) of lead was detected in the northern portion of Site 3 north of Building 517 in a sample from S03-DGS-DP15 at 6 to 6.5 feet bgs.

Lead is relatively immobile under most soil conditions because it sorbs to organic matter and forms complexes with inorganic clays. Lead can migrate from soil to groundwater primarily under acidic conditions (Lindsay 1979); pH levels from soil samples collected at Site 3 ranged from 6.7 to 9.4. The geochemical conditions at Site 3 will tend to stabilize lead in soil, reducing the amount of available lead that could migrate to groundwater.

5.3.5.5 *Polynuclear Aromatic Hydrocarbons in Soil*

Elevated concentrations of PAHs in soil were detected in two areas at Site 3. The maximum PAH concentration expressed as B(a)P equivalent was detected in a sample from 4 to 8 feet bgs near the northeastern edge of Site 3 in an area where marsh crust is known to be present at approximately that depth. Other areas of elevated PAH concentrations are in the area of high petroleum contamination in the southern portion of Site 3 at shallow depths.

PAHs are not subject to degradation processes and bind to organic matter in soil. In addition, they are mostly insoluble in water and exhibit low potential for migration, but can become mobile in the presence of petroleum hydrocarbons and some solvents. The PAHs likely will remain at their present locations in soil.

5.3.5.6 *Lead in Groundwater*

Lead was detected at elevated concentrations in several groundwater samples collected in the northern portion of the site near the elevated lead in soil locations. The groundwater flow direction in this portion of Site 3 is northwest. The pH levels in groundwater samples collected from this area are slightly basic, which would retard the movement of lead from soil to groundwater and of the lead in groundwater because of the increased sorption of lead to aquifer materials. In addition, the bay sediment unit clays, which are directly below the area of known elevated lead concentrations, are expected to sorb lead.

The storm sewer present in the vicinity of the lead plume was found to be in sound condition (Tetra Tech 2000b). It is unlikely the storm sewer will act a a preferential pathway for this lead plume in groundwater.

5.3.6 Human Health Risk Assessment

A site-specific HHRA was conducted for Site 3 as part of the RI to estimate potential human health risks associated with potential exposures to site-related chemicals during current and future uses of the site. Section 3.4.6 summarizes the approach used to conduct the HHRA. This section summarizes the HHRA results for soil at Site 3 and the lead groundwater plume in the northern portion of the site, and Section 9.0 summarizes the OU-wide groundwater plume HHRA results. The following sections discuss chemicals of potential concern (COPC), the exposure assessment, and the risk characterization for the HHRA. Appendix F presents the complete HHRA.

5.3.6.1 Chemicals of Potential Concern

Data for soil, groundwater, and soil gas samples collected within and around the Site 3 boundaries were used to conduct the HHRA. Chemicals in soil or groundwater considered to be essential nutrients (such as calcium, magnesium, potassium, and sodium) were excluded as COPCs. All other chemicals were retained for evaluation in the HHRA. Lead was selected as a COPC and was evaluated using the LeadSpread model (DTSC 2003).

5.3.6.2 Exposure Assessment

According to reuse plans for Alameda Point (EDAW 1996), residential, and commercial/industrial uses most likely apply to future exposures at Site 3. These exposure scenarios, along with construction worker exposure, were evaluated for the following pathways.

- **Residential** – incidental soil ingestion, dermal contact with soil, inhalation of particulates from soil (nonvolatile), ingestion of homegrown produce, inhalation of vapors in ambient air, inhalation of vapors in indoor air, and domestic use of groundwater (ingestion, dermal contact, and inhalation of vapors)

- **Commercial/Industrial** – soil ingestion, dermal contact with soil, inhalation of particulates from soil (nonvolatile), inhalation of VOCs in ambient air, and inhalation of VOCs in indoor air

- **Construction Worker** – soil ingestion, dermal contact with soil, inhalation of particulates from soil (nonvolatile), inhalation of VOCs in ambient air, and inhalation of vapors in ambient air

For all receptors, soil data were aggregated in depth intervals of 0 to 2 feet bgs (surface soil) and 0 to 8 feet bgs (subsurface soil). Exposure to subsurface soil was evaluated for future human receptors in the event that subsurface soils are brought to the surface during redevelopment activities.

5.3.6.3 Risk Characterization

The potential for noncancer health effects is expressed as an HI. If the resulting HI is less than 1, it is assumed that there is no significant potential for noncancer health effects due to cumulative effects. If the total HI exceeds 1, a "segregation of hazard indices" analysis is conducted. In this analysis, chemicals that have similar target organs are grouped together, and an HI is calculated for each group. If the HI for a target organ exceeds 1, there is potential for noncancer health effects.

It is important to note that the noncancer HI is estimated differently than lifetime cancer risk; specifically, a child's exposure is not cumulatively additive to the projected adult exposure. Noncancer effects manifest over a specific time period, and once the exposure period is over, the hazard has also passed (that is, no latency is assumed). Therefore, because a child receptor has the highest potential risk, risk management decisions for chemicals with noncancer health effects are based on the HI for a child for the residential scenarios. The total HI that includes background chemicals is calculated for all scenarios, and an incremental HI (which does not include background) is also calculated for a child resident.

Unlike noncancer health effects, which assume that there is no significant potential for noncancer health effects if the HI is below 1, cancer risks associated with exposure to chemicals classified as carcinogens are estimated as the incremental probability that an individual will develop cancer over a lifetime as a direct result of an exposure. Risk management decisions for chemicals with cancer effects are based on lifetime or total risk; therefore, risks for adult and child receptors are summed to obtain a total cancer risk. To aid in the interpretation of the results, EPA guidance presents a range of goals for residual cancer risk, which is "an excess upper-bound lifetime cancer risk to an individual of between 1 in 1,000,000 to 1 in 10,000" or between 1E-06 and 1E-04. The range between 1E-06 and 1E-04 is referred to as the "risk management range."

The reasonable maximum exposure (RME) cancer risks and noncancer HIs for soil and the lead groundwater plume at Site 3 are summarized below by scenario. See Section 9.0 for a summary of risk from the OU-wide groundwater plume. RME and CTE carcinogenic risks and noncancer HIs for soil are presented in Table 5-21.

Soil

For the commercial/industrial and construction worker scenarios, the highest RME cancer risk for surface soil is 1E-05, which is within the risk management range of 1E-06 to 1E-04 (see Tables 5-21). The highest total RME HI is 1 for the construction worker, which is equal to the risk management HI of 1 for noncarcinogens. No individual COPC exceeds a hazard quotient (HQ) of 1. The RME HI for the commercial/industrial worker is 0.4. Commercial/industrial worker risk drivers for surface and subsurface soil are presented in Table 5-22 and 5-23.

The residential scenario is considered the most conservative estimate of risk. For surface soil, the cancer risk is 7E-05, which is within the risk management range 1E-06 to 1E-04 (see Table 5-21). The noncancer HI for a child is 5, which is greater than the threshold HI of 1 for noncarcinogens (see Table 5-21). Risk drivers for surface soil are presented below (see Table 5-24).

- Arsenic
- PAHs (B[a]P, benzo(a)anthracene, benzo(a)pyrene, dibenzo(a,h)anthracene)
- Aroclor-1260

Soil risks are attributed primarily to arsenic, and arsenic at Site 3 is attributed to background. The carcinogenic risk from PAHs alone is 2E-05 and is within the risk management range.

For the commercial/industrial and construction worker scenarios, the highest RME carcinogenic risk for subsurface soil is 2E-05, which is within the risk management range (see Table 5-21). The highest RME HI is 1 for the construction worker, which is equal to the risk management HI of 1 for noncarcinogens. No individual COPC exceeds a hazard quotient of 1. The RME HI for the commercial/industrial worker is 0.5.

For subsurface soil under the residential scenario, the carcinogenic risk is 1E-04, which is within the risk management range (see Table 5-21). The noncancer HI for a child is 6. Carcinogenic and noncarcinogenic risk drivers for subsurface soil are presented below (see Table 5-25).

- Arsenic
- PAHs (B[a]P, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenzo[a,h]anthracene)
- Aroclor-1260
- Benzene
- Iron

Soil risks from surface and subsurface soils are primarily attributed to PAHs and arsenic. Based on the background comparison, arsenic is attributed to background. The carcinogenic risk from PAHs is 2E-05 and is within the risk management range.

Lead in Soil and Groundwater

Lead was selected as a COPC for Site 3 soil and groundwater and OU-wide groundwater and was evaluated using LeadSpread. Lead in Site 3 soil and groundwater and OU-wide groundwater was not attributed to background. For surface and subsurface soil, the EPCs for lead were 369 and 180 mg/kg, respectively. For water ingestion, three EPC s were used: 210 µg/L for the Site 3 lead groundwater plume, 5.7 µg/L for the OU-wide groundwater plume, and 0.15 µg/L for East Bay Municipal District (EBMUD) drinking water.

For surface soil, the LeadSpread model predicts that the 95th percentile estimate of blood lead is 40.3 micrograms per deciliter (µg/dL) for a child ingesting Site 3 soil and groundwater from the lead plume. The LeadSpread model predicts that the 95th percentile estimate of blood lead is 12.3 µg/dL for a child ingesting Site 3 soil and OU-wide groundwater, and 11.3 µg/dL for a child ingesting Site 3 soil and EBMUD drinking water (see Appendix F). All of these blood lead levels exceeded the comparison criterion of 10 µg/dL. Based on LeadSpread results, there is potential risk to human health from ingestion of lead in Site 3 surface soil and groundwater. The comparison criterion of 10 µg/dL equates to a soil concentration of 299 mg/kg when EBMUD is the drinking water source.

For subsurface soil, the LeadSpread model predicts that the 95th percentile estimate of blood lead is 35.1 µg/dL for a child ingesting Site 3 soil and groundwater from the lead plume. This blood lead level exceeded the comparison criterion of 10 µg/dL. The LeadSpread model predicts that the 95th percentile estimate of blood lead is 7.1 µg/dL for a child ingesting Site 3 soil and OU-wide groundwater, and 6.1 µg/dL for a child ingesting Site 3 soil and EBMUD drinking water (see Appendix F). These values are less than the comparison criterion of 10 µg/dL. Based on LeadSpread results, there is potential risk to human health from ingestion of lead in Site 3 surface soil and groundwater. The comparison criterion of 10 µg/dL equates to a soil concentration of 299 mg/kg when EBMUD is the drinking water source.

5.3.7 Ecological Risk Assessment

A site-specific ERA was conducted for Site 3 to estimate potential risks to ecological receptors. Section 3.4.7 summarizes the approach used to conduct the ERA. The following sections discuss chemicals of potential ecological concern (COPEC), the ERA problem formulation, and assessment results. Appendix G presents the complete ERA.

5.3.7.1 Chemicals of Potential Ecological Concern

Data for soil collected within and around the site boundaries of Site 3 were used to conduct the ERA. Table 5-26 summarizes COPECs for soil from 0 to 4 feet bgs. Groundwater in the OU-wide plume was evaluated for all OU-2B sites and is discussed separately in Section 9.0.

5.3.7.2 Problem Formulation

Site 3 does not contain ecological habitat capable of supporting significant wildlife; however, exposure pathways for terrestrial receptors were considered potentially complete to provide a conservative estimate of risk. Using a fully exposed soil scenario, the following complete exposure pathways were identified for Site 3.

- Direct exposure to soil
- Food chain exposure

The following selected assessment and measurement endpoints were identified for evaluation.

- Reproductive or physiological impacts to the California ground squirrel *(Citellus beecheyi)* as indicated by HQs developed based on both high (lowest observed adverse effect level [LOAEL]-based) and low (no observed adverse effect level [NOAEL]-based) toxicity reverence values (TRV)
- Reproductive or physiological impacts to the Alameda song sparrow *(Melospiza melodia pusillula)* as indicated by HQs developed based on both high (LOAEL-based) and low (NOAEL-based) TRVs

- Reproductive or physiological impacts to the American robin (*Turdus migratorius*) as indicated by HQs developed based on both high (LOAEL-based) and low (NOAEL-based) TRVs

- Reproductive or physiological impacts to the red-tailed hawk *(Buteo jamaicensis)* as indicated by HQs developed based on both high (LOAEL-based) and low (NOAEL-based) TRVs

5.3.7.3 Ecological Risk Assessment Results

High and low TRVs were used to provide a bounding estimate of risk to each ecological receptor. The high TRV represents an upper bounding limit, which is the lowest concentration that adverse effects are known to occur. The low TRV represents the lower bounding limit, which is the highest concentration that an endpoint receptor can be exposed to that does not result in adverse effects. If both HQ values for a chemical were below 1.0, the ecological endpoint receptor is considered to be exposed to no potential risk from soil. Chemicals with one or both bounding limit HQs exceeding 1.0 were evaluated further based on background chemical concentrations, each chemical's frequency of detection and distribution at the site, the range of concentrations detected, and its absorption potential and toxicity to each ecological receptor. This type of analysis provides additional weight-of-evidence data to support risk management decisions for the sites. Assessment results for Site 3 soil for small mammal, passerine, and raptor populations are discussed below. Table 5-27 summarizes both high and low TRV HQ results for soil.

Small Mammal Populations

For small mammal populations, the California ground squirrel is the measurement endpoint receptor. The following soil COPECs had HQs above 1.0:

- Aluminum: 109,1090
- Lead: 8.6
- Vanadium: 4.5
- Toluene: 2.4 and 24
- Copper: 3.8
- Manganese: 4.6
- Zinc: 10
- Xylene: 662 and 815

Literature data were not adequate to develop mammalian ecological reference values (ERV) for the VOCs 2-butanone, carbon disulfide, and ethylbenzene; therefore, a qualitative evaluation was conducted. All other COPECs evaluated at Site 3 posed no significant risk to small mammals based on an HQ less than 1.0 for both the low and high TRVs.

Aluminum, toluene, and xylene had HQ values above 1.0 for both the high and low TRV values. Aluminum, which exceeds aluminum's maximum background level at Site 3, was detected in all 14 samples collected at concentrations ranging from 3,820 to 22,400 mg/kg. Background concentrations ranged from 1,760 to 22,600 mg/kg. Based on these ranges of concentrations, aluminum appears to be present at naturally high levels in Alameda Point soil; therefore, aluminum was determined to pose no significant potential risk to small mammals above risk posed by background concentrations.

Toluene was detected in 6 of 13 samples collected at concentrations ranging from 0.002 to 210 mg/kg, and xylene was detected only in 2 of 13 samples collected at concentrations of 2.3 and 250 mg/kg. The HQ values for toluene and xylene are driven by the relatively conservative soil-to-invertebrate bioconcentration factor ($BCF_{soil\text{-}to\text{-}invert}$) values of 12.3 and 29.84, respectively, which were calculated using the K_{ow} values of 2.73 and 3.2. However, ecological risks at Site 3 from exposure to toluene and xylene of small mammals cannot be discounted.

Only the low TRV HQs for copper, lead, manganese, vanadium, and zinc were above 1.0. Based on background metals concentrations at Alameda Point, the absorption potential of each chemical, the frequency of detection, BCFs used in risk calculations, habitat available at the site, and the concentrations at Site 3, manganese and vanadium were determined to pose no significant potential risk to small mammals. The risks from copper and zinc could not be discounted. See Appendix G for a complete explanation. Lead at Site 3 does pose potential risk to small mammals.

Carbon disulfide and 2-butanone were detected in 1 of 13 samples collected. The maximum concentrations for both these chemicals were below the maximum reporting limit of 13 mg/kg. Ethylbenzene was detected in 2 of 13 samples at concentrations of 0.94 and 50 mg/kg. In general, VOCs have toxic effects only at concentrations in the 500- to 1,000-mg/kg range (ATSDR 1992b, 1996a, and 1996b). Based on this information, the low detection frequencies, and relatively low concentrations, the risk at Site 3 to small mammals from exposure to residual levels of VOCs is expected to be low.

Passerine Populations

For passerine populations, the Alameda song sparrow and American robin are the measurement endpoint receptors. The following soil COPECs had HQs above 1.0.

- Aluminum: 3.1
- Lead: 228 (sparrow) and 763 (robin)

Literature data were not adequate to develop bird ERVs for the metal cobalt; high molecular weight (HMW) PAHs and low molecular weight (LMW) PAHs; and the VOCs 2-butanone, acetone, benzene, carbon disulfide, ethylbenzene, toluene, and xylene. As a result, a qualitative evaluation was conducted. All other COPECs evaluated at Site 3 were determined to pose no significant risk to passerine birds based on HQ values of less than 1.0 for both the low and high TRVs.

Only the low TRV HQs for aluminum and lead were above 1.0. After consideration of background concentrations at Alameda Point, the absorption potential of the chemical, the frequency of detection, BCFs used in risk calculations, habitat available at the site, and the concentrations at Site 3, aluminum was determined to pose no significant potential risk to passerine birds above risk posed by background concentrations; however, there is a potential risk to passerine birds from exposure to lead at Site 3.

The qualitative evaluation of risk to passerine birds from exposure to cobalt, HMW PAHs, LMW PAHs, 2-butanone, acetone, benzene, carbon disulfide, ethylbenzene, toluene, and xylene involved assessing the weight-of-evidence parameters. Cobalt was detected at Site 3 in 10 of 14 samples collected at concentrations ranging from 4.4 to 11.1 mg/kg, and background concentrations ranged from 3.02 to 49.7 mg/kg. Based on these background concentrations, most of the dose of cobalt to passerine birds is attributable to cobalt's background concentration. Very little information is available concerning the effects of cobalt on bird species. Potential risk to passerine birds from cobalt at Site 3 is not expected to exceed the risk posed by background concentrations of cobalt.

The HMW and LMW PAHs were detected at Site 3 at frequencies ranging from 49 to 94 percent out of a total of 156 samples collected. Calculated EPCs ranged from 0.015 to 1.05 mg/kg. PAHs can cause genotoxic, reproductive, and mutagenic effects; however, studies indicated that PAHs do not appear to bioaccumulate in mammals and birds (Eisler 1987). Based on the relatively high frequency of detection, the risk at Site 3 posed to passerine birds from residual levels of HMW and LMW PAHs cannot be discounted.

The VOCs 2-butanone, benzene, and carbon disulfide were detected in only 1 of 13 samples collected from Site 3; acetone, ethylbenzene, and xylene were detected in 2 of 13 samples; and toluene was detected in 6 of 13 samples. Concentrations ranged from 0.01 to 250 mg/kg. The risk at Site 3 posed to passerine birds from residual concentrations of VOCs in soils cannot be discounted but is postulated to be low because mammals and birds quickly metabolize VOCs.

Raptor Populations

For raptor populations, the red-tailed hawk is the measurement endpoint receptor. The following soil COPECs had HQs above 1.0.

- Aluminum: 1.8 and 16
- Lead: 1,840

Literature data were not adequate to develop bird ERVs for the metal cobalt; HMW PAHs and LMW PAHs; and the VOCs 2-butanone, acetone, benzene, carbon disulfide, ethylbenzene, toluene, and xylene. As a result, a qualitative evaluation was conducted. All other COPECs evaluated at Site 3 were determined to pose no significant risk to raptors based on HQ values of less than 1.0 for both the low and high TRVs.

Aluminum had HQ values above 1.0 for both the high and low TRV values. Aluminum, which is present above background levels at Site 3, was detected in all 14 samples collected at Site 3, with concentrations ranging from 3,820 to 22,400 mg/kg. Background concentrations ranged from 1,760 to 22,600 mg/kg. Based on these ranges of concentrations, aluminum appears to be present at naturally high levels in soil at Alameda; therefore, aluminum at Site 3 does not pose significant risk to raptors above risk posed by background concentrations.

Only the low TRV HQ for lead of 1,840 for the red-tailed hawk was above 1.0; however, this HQ may be driven by the overly conservative low TRV value. The alternate low TRV HQ calculated for the red-tailed hawk was 5.07. Based on this information, lead at Site 3 poses potential risk to raptors.

The qualitative evaluation of risk to raptors from exposure to cobalt, HMW PAHs, LMW PAHs, 2-butanone, acetone, benzene, carbon disulfide, ethylbenzene, toluene, and xylene involved assessing the weight-of-evidence parameters. As discussed above for passerine birds, potential risk at Site 3 posed to raptors from cobalt is not expected to exceed the risk posed from background concentrations of these chemicals.

Impacts to raptors from HMW PAHs and LMW PAHs could not be discounted because of the lack of information concerning long-term impacts of exposure to multiple PAHs at Site 3.

Risks posed to raptors at Site 3 from exposure to 2-butanone, acetone, benzene, carbon disulfide, ethylbenzene, toluene, and xylene also could not be discounted but were expected to be low based on the low frequency of detection and low concentrations of these chemicals at Site 3.

5.4 SITE 3 CONCLUSIONS AND RECOMMENDATIONS

This section summarizes conclusions and recommendations on the nature and extent of chemicals in soil and the lead groundwater plume at Site 3 and the risk posed by those chemicals. The contents of this section are based on (1) the site-specific CSM, (2) a background comparison, (3) the nature and extent evaluation, (4) the fate and transport evaluation, (5) the HHRA, and (6) the ERA.

5.4.1 Nature and Extent Conclusions

The nature and extent evaluation concluded that many of the chemicals detected across Site 3 are consistent with historical activities that occurred at the site; however, lead detected in soil and groundwater was not considered to be consistent with the historical activities. Chemicals appear to have been released to soil in the following four areas: (1) south of former Building 264, (2) in the vicinity of the refueling facilities and USTs in the southern area of the site, (3) north of Building 517, and (4) along the eastern edge of Site 3.

The pesticides alpha-chlordane, gamma-chlordane, chlordane, and 4,4-DDT were detected in surface soil in a landscaped area south of former Building 264. The presence of these chemicals most likely is related to the historical use of these pesticides on landscaped areas around Building 264.

Two VOCs (benzene and ethylbenzene) were detected at concentrations exceeding screening levels and appear to be localized in the western portion of Site 3 near fuel lines. VOCs with detection limits that exceeded 2002 PRGs included 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 2-butanone, 4-metyl-2-pentanone, isopropylbenzene, m,p-xylene, methylene chloride, MTBE, o-xylene, toluene, and total xylene. The presence of these compounds in soil most likely resulted from releases of petroleum products, which were used extensively at Site 3.

The PCB, Aroclor-1260, was also detected in surface soil samples collected in the northern half of the site, within the vicinity of Buildings 517 and 517A (garden equipment storage) and near the southern end of Building 264 (exchange service outlet). There are no transformers in these areas with documented usage of Aroclor 1260. Oils containing PCBs (Aroclor 1260) were used as an extender for pesticides around the site and were likely mixed in the garden shops (Buildings 517 and 517A). Aroclor-1260 in Site 3 soil likely is related to the use of oils containing PCBs to control weeds and minimize dust.

Iron was detected in soil at Site 3 and appears to be uniformly distributed and unrelated to storm sewers, buildings, or other site features, which suggests that iron occurs randomly with no apparent source and may be naturally occurring. The highest detections of iron in soil were detected below the artificial fill, with the maximum detected concentration between 9.0 and 10.0 feet bgs at a location in the southeastern portion of Site 3.

Elevated concentrations of lead are localized in soil in the northern portion of Site 3, north of Building 517, at depths from 0.5 to 6.5 feet bgs, and along the eastern edge of the site from 4 to 4.5 feet bgs. Lead was detected at elevated concentrations in several groundwater samples collected near the elevated concentrations of lead in soil in the northern portion of Site 3. The lead groundwater plume extends approximately 200 feet north to south, and the vertical extent is unknown. The source of lead in groundwater in this area is unknown; however, a storm sewer catch basin (6H-5A) and manhole (6H-5) are also located in this area. It is unknown if the storm sewer in this area is in contact with groundwater or not, but a significant sag is located directly west of the manhole (Tetra Tech 2000b). The groundwater in this portion of Site 3 flows to the northwest. The pH levels in groundwater samples collected from this area are slightly basic, which would retard the movement of lead from soil to groundwater and of lead in groundwater because of the increased sorption of lead to aquifer materials.

Elevated concentrations of PAHs in soil appear to be localized in the northeastern portion of Site 3 and in the southern portion of the site near former USTs 97-A through 97-E. The maximum concentration was detected in a sample from 4 to 8 feet bgs in the northeastern portion of Site 3 in an area where marsh crust is known to be present. Elevated concentrations in the southern portion of Site 3 may be attributed to petroleum releases that occurred from the USTs or from activities related to the refueling of aircraft trucks.

These pesticides, VOCs, and PCBs detected in soil discussed above were not detected in direct-push groundwater data collected in the northern area of the site.

5.4.2 Risk Assessment Conclusions

This section discusses HHRA and ERA results from the evaluation of risk from chemicals detected in soil and the lead groundwater plume at Site 3. Risk assessment results for the OU-wide groundwater plume are presented in Section 9.0.

Although numerous chemicals were detected at Site 3, some of these chemicals do not pose significant risk as defined by the risk assessments. Based on the HHRA, arsenic, benzene, Aroclor-1260, iron, lead, and PAHs (benzo[a]anthracene, B[a]P, benzo[b]fluoranthene, dibenzo[a,h]anthracene) in soil and lead in the lead groundwater plume were identified as risk drivers. Based on the ERA, lead and PAHs in soil were identified as risk drivers. According to the background comparison, arsenic is attributed to background.

5.4.2.1 Human Health Risk Assessment Conclusions

According to reuse plans for Alameda Point (EDAW 1996), residential and commercial/industrial exposures are the most likely future exposures at Site 3. Human health risk was evaluated for residential and commercial/industrial exposures, along with construction worker exposure. HHRA results for soil and the groundwater lead plume are summarized below.

Soil

For the commercial/industrial and construction worker scenarios, the most conservative RME carcinogenic risks for Site 3 soil are within the risk management range of 1E-06 to 1E-04. The most conservative RME noncancer HI for soil is 0.5, which is less than the threshold HI of 1.

The residential scenario is considered the most conservative estimate of risk. For surface and subsurface soil, RME carcinogenic risks are within the risk management range. The surface soil RME noncancer HI for a child is below 5, and the subsurface soil noncancer HI for a child is 6.

Residential soil risks are primarily attributed to arsenic, lead, and PAHs (B[a]P). Based on the background comparison, arsenic is attributed to background.

Lead in Soil and Groundwater

Lead was selected as a COPC for Site 3 soil and groundwater and OU-wide groundwater and was evaluated using LeadSpread. Lead in site soil and groundwater and OU-wide groundwater was not attributed to background. For water ingestion, three EPCs were used: Site 3 lead groundwater plume, OU-wide groundwater plume, and EBMUD drinking water. Based on LeadSpread results, there is potential risk to human health from ingestion of lead in Site 3 soil and groundwater. The child blood lead level of 10 μg/dL equates to a soil concentration of 299 mg/kg when EBMUD is the drinking water source.

5.4.2.2 Ecological Risk Assessment Conclusions

A site-specific ERA was conducted for Site 3 soil to estimate potential risks to the environment. Currently, Site 3 does not contain ecological habitat capable of supporting significant wildlife; however, exposure pathways for terrestrial receptors were considered potentially complete to provide a conservative estimate of risk.

Assessment endpoint receptors include small mammals, passerines, and raptors. Lead in soil was identified as posing potential risk to small mammals and birds (passerines and raptors). PAHs in soil were identified as posing potential risk to passerines and raptors.

5.4.3 Recommendations

Based on the data and risks discussed above, soil and the lead groundwater plume at Site 3 are recommended for further evaluation in an FS, as defined under CERCLA, to address risks to residential receptors under the unrestricted reuse scenario. Aroclor-1260, benzene, lead, and PAHs are identified as chemicals of concern (COC) for soil at Site 3, and lead is identified as a COC for groundwater at Site 3.

PAHs at Site 3 are attributed to the Marsh Crust (northeastern portion of the site) and a TPH release (southern portion of the site). The Marsh Crust record of decision is applicable to the PAHs in soils within the northeastern portion of Site 3.

Arsenic and iron were also identified as risk drivers for soil but are not recommended as COCs for further evaluation in the FS because these metals are attributed to background.

Although chemicals were identified that could pose a risk to ecological receptors, there is little likelihood Site 3 will be used for ecological habitat. Therefore, the risks identified for ecological receptors are overestimated. No action is recommended for chemicals based on potential risk posed to ecological receptors.

The following data gaps were also identified.

- Further delineation of lead in soil east and west of sampling locations 129-001-002 and M03-07 and groundwater near well M04-03 is recommended.
- Further delineation of soil below former Building 109 is recommended based on staining that appeared in aerial photographs and the presence of a large plume of petroleum hydrocarbons commingled with VOCs that was identified beneath the area of former staining.
- Because of elevated detection limits, further sampling and analysis of soil may be necessary to confirm SVOCs are not present in soil at Site 3.

An evaluation of TPH in soil and groundwater also was conducted based on the TPH Strategy for Alameda Point. On the basis of this evaluation, no further action is recommended for Site 3 soil and further action is recommended for Site 3 groundwater for TPH-associated constituents. TPH-impacted groundwater is addressed further in the OU-wide groundwater section (Section 9.0).

FIGURES

FINAL OPERABLE UNIT 2B
REMEDIAL INVESTIGATION REPORT
SITES 3, 4, 11, AND 21

DATED 05 AUGUST 2005

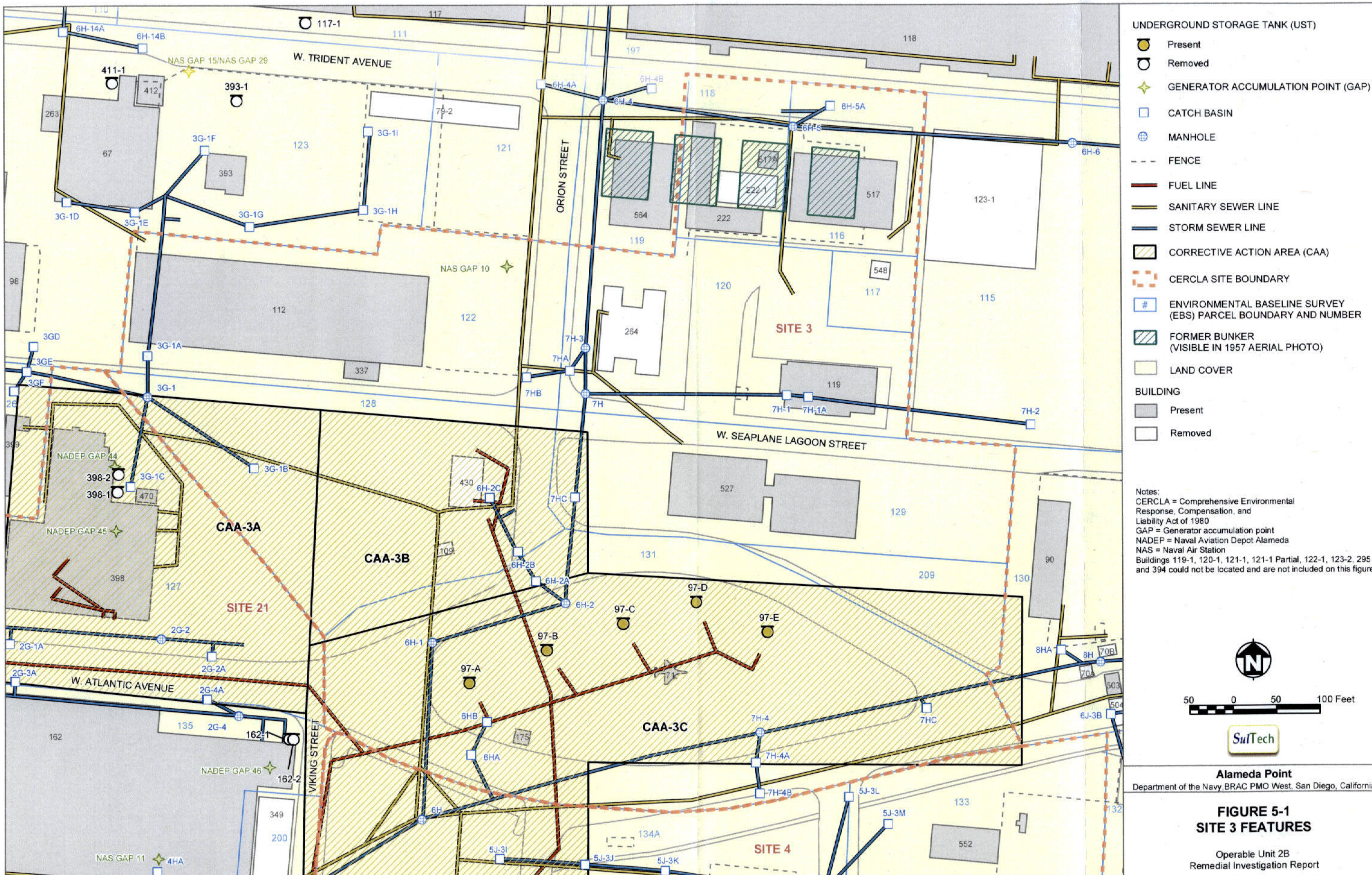

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FIGURE 5-1
SITE 3 FEATURES

Operable Unit 2B
Remedial Investigation Report

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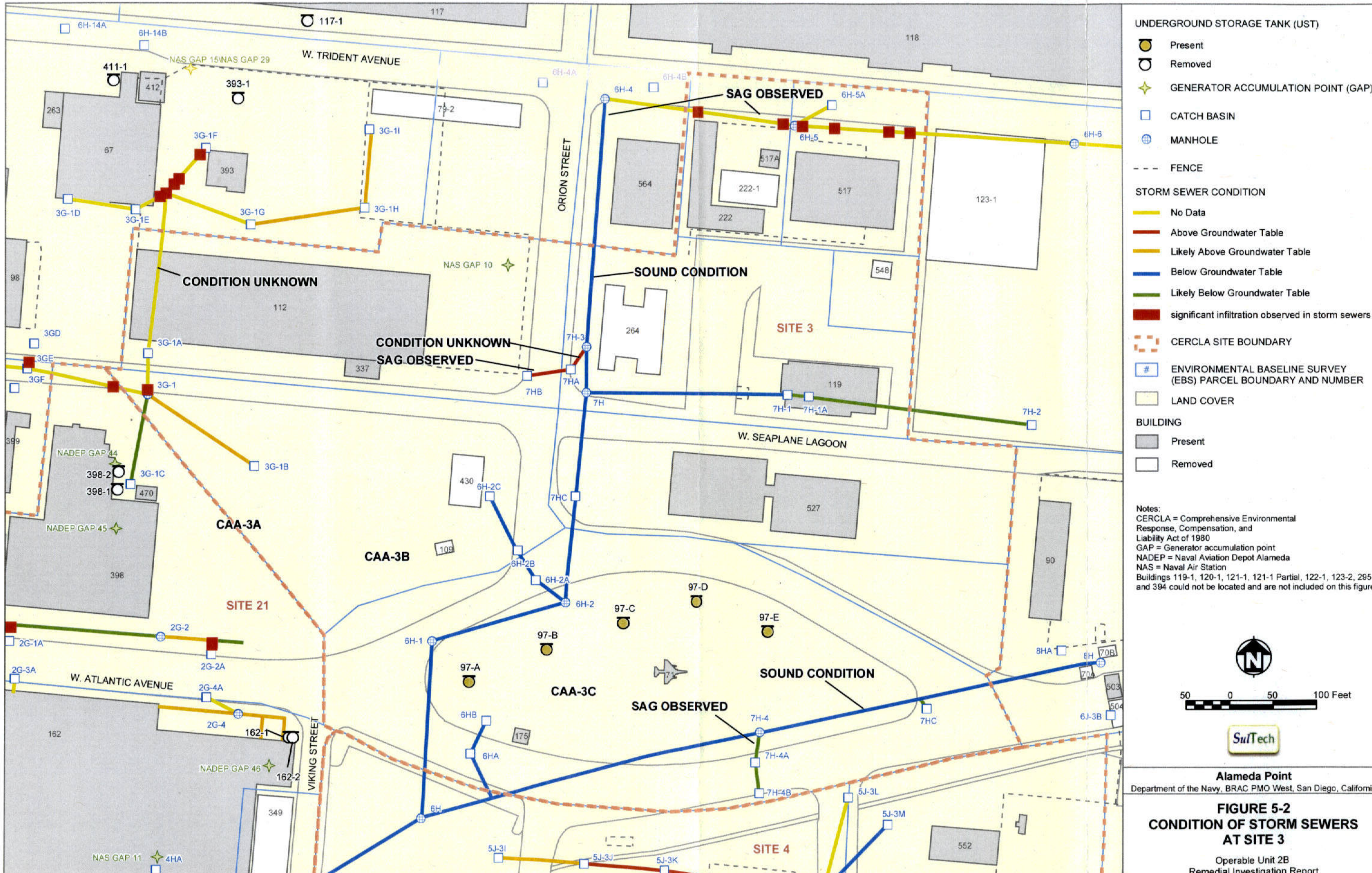

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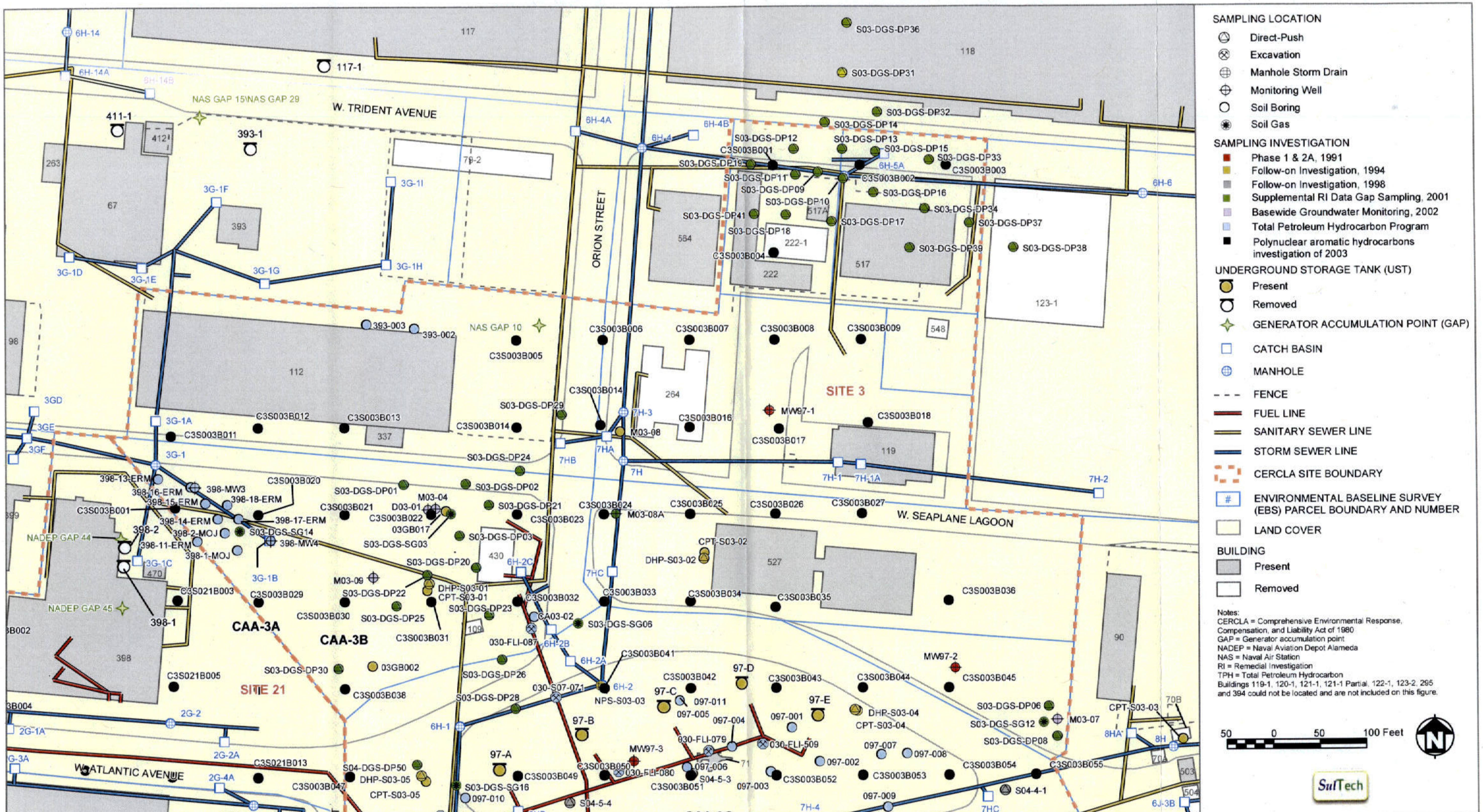

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FIGURE 5-3
SITE 3 SAMPLING LOCATIONS FOR THE CERCLA AND TPH INVESTIGATIONS

Operable Unit 2B
Remedial Investigation Report

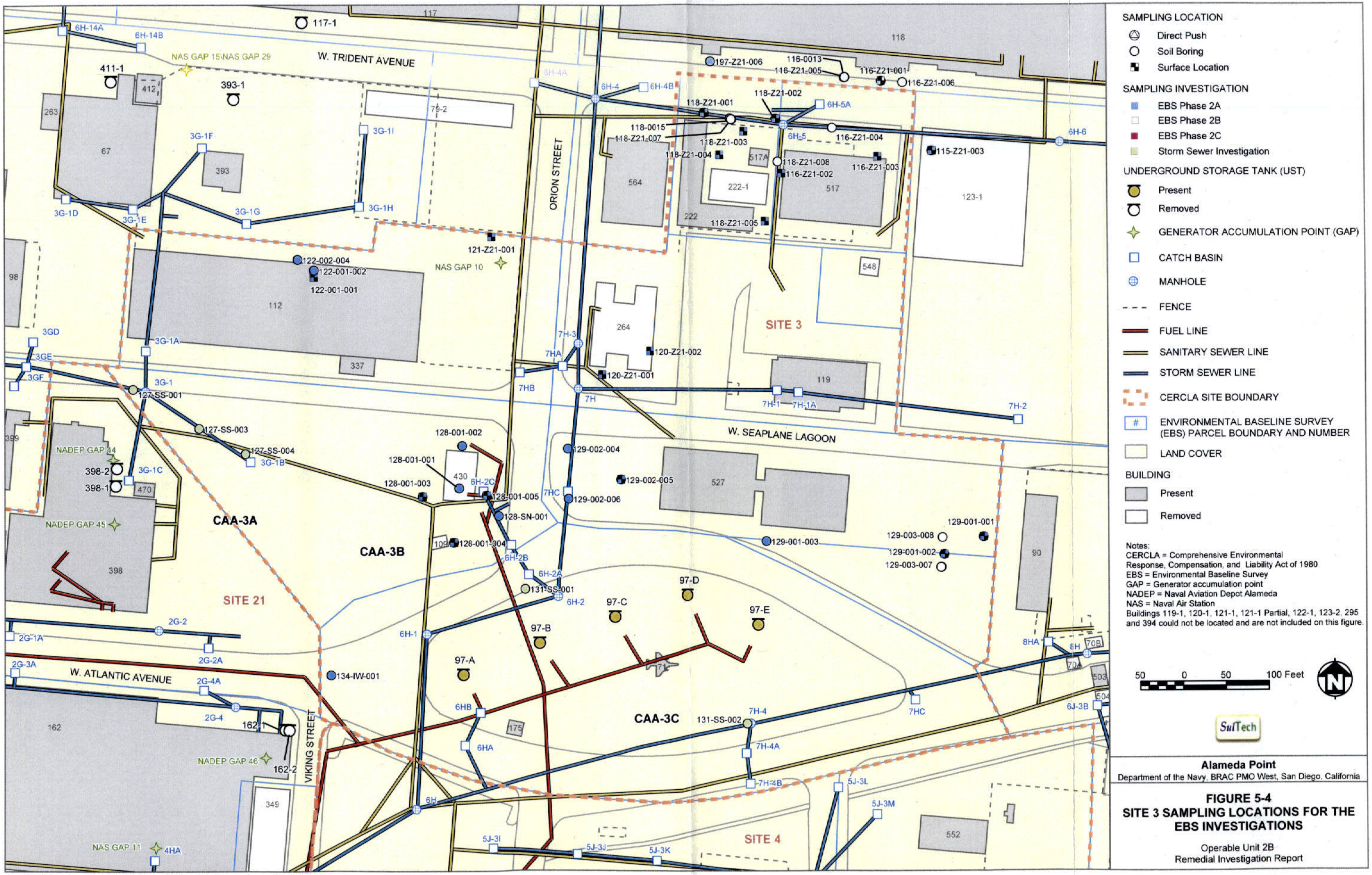

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FIGURE 5-4
SITE 3 SAMPLING LOCATIONS FOR THE EBS INVESTIGATIONS

Operable Unit 2B
Remedial Investigation Report

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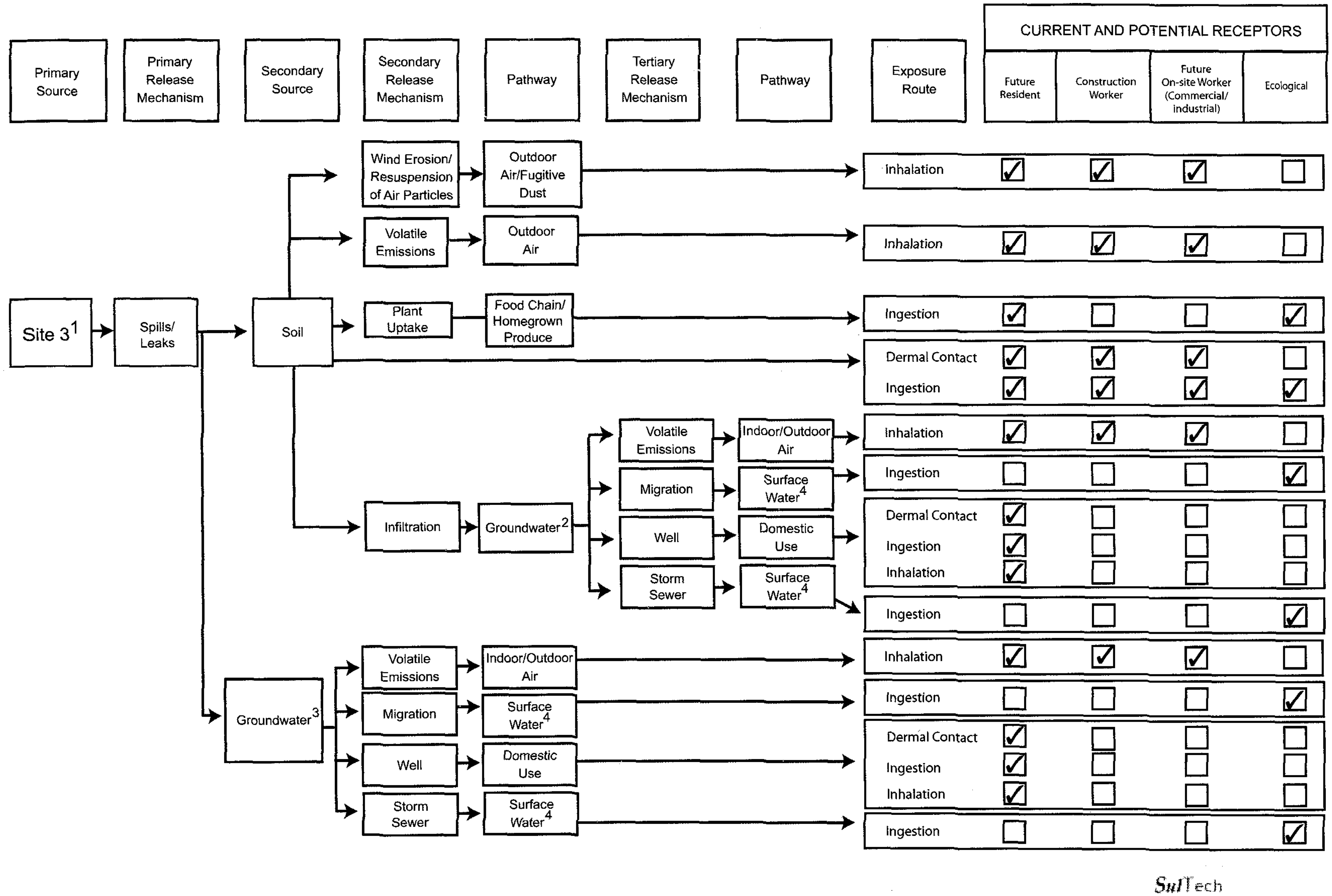

1 Former Structure 430, weed and dust control, and USTs 97-A through 97-E and associated fuel lines
2 *OU-wide groundwater and Site 3 lead groundwater plume*
3 OU-wide groundwater plume
4 Seaplane Lagoon

☑ Potentially complete pathway, exposure quantified

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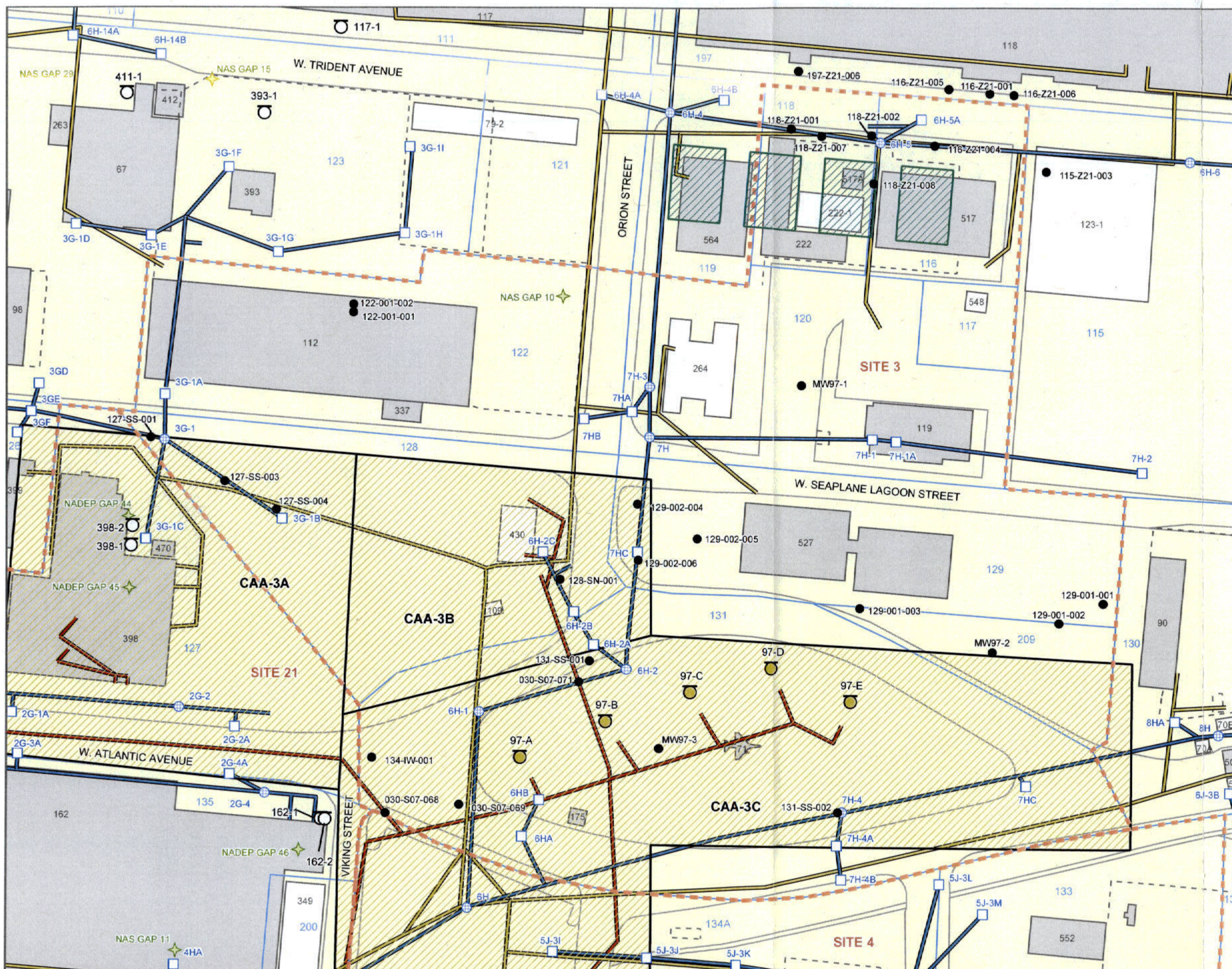
FIGURE 5-05
SITE 3 CONCEPTUAL SITE MODEL
Operable Unit 2B
Remedial Investigation Report



SAMPLING LOCATION

- Location analyzed for SVOCs in soil

UNDERGROUND STORAGE TANK (UST)

- Present
- Removed
- GENERATOR ACCUMULATION POINT (GAP)
- CATCH BASIN
- MANHOLE
- FENCE
- FUEL LINE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CORRECTIVE ACTION AREA (CAA)
- CERCLA SITE BOUNDARY
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL BOUNDARY AND NUMBER
- FORMER BUNKER (VISIBLE IN 1957 AERIAL PHOTO)
- LAND COVER

BUILDING

- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
GAP = Generator accumulation point
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, 295 and 394 could not be located and are not included on this figure.

50 0 50 100 Feet

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FIGURE 5-6
SITE 3 SAMPLING LOCATIONS FOR SVOCs IN SOIL

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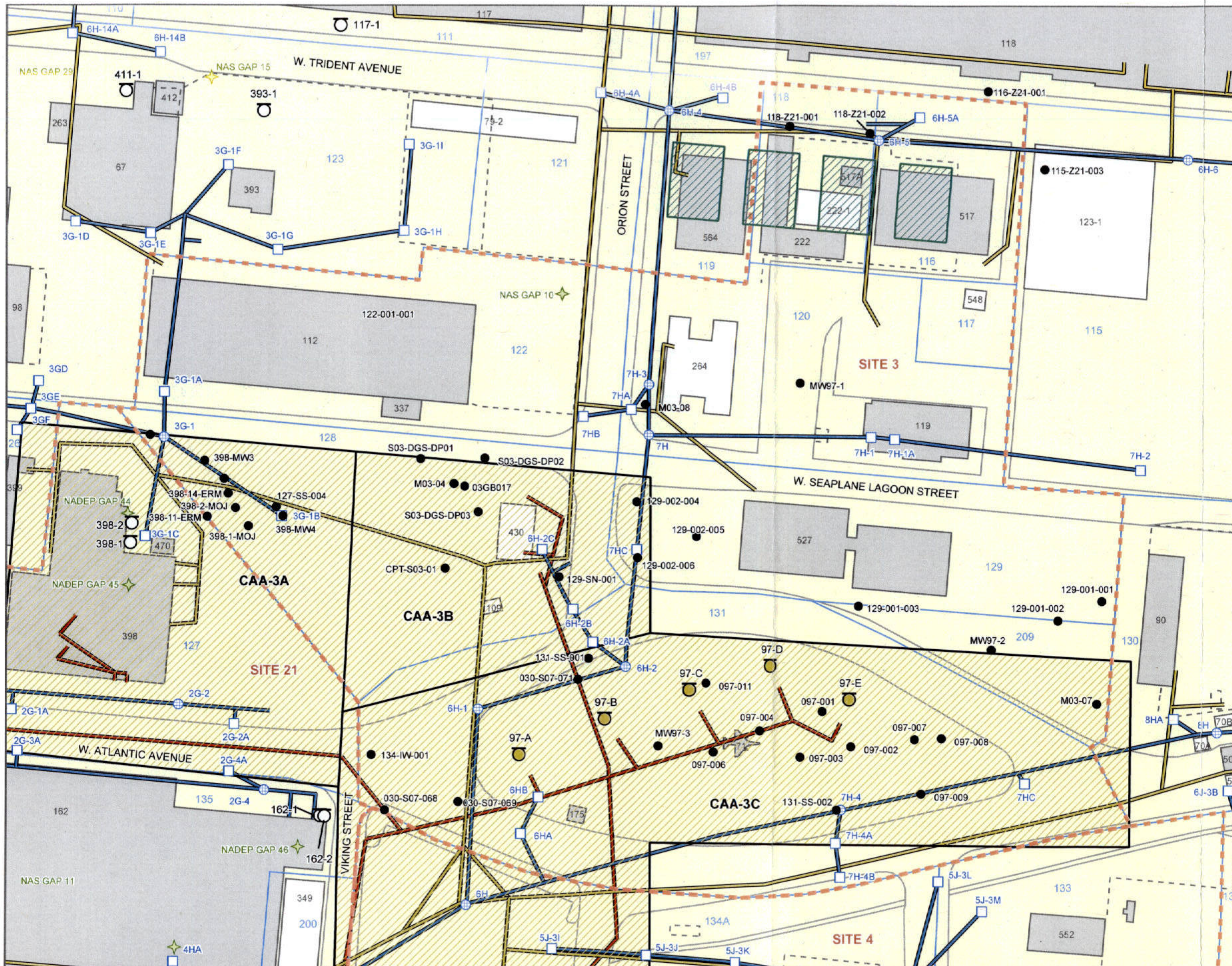

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
GAP = Generator accumulation point
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, 295 and 394 could not be located and are not included on this figure.

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FIGURE 5-7
SITE 3 SAMPLING LOCATIONS FOR VOCs IN SOIL

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FIGURE 5-8
SITE 3 SAMPLING LOCATIONS FOR METALS IN SOIL

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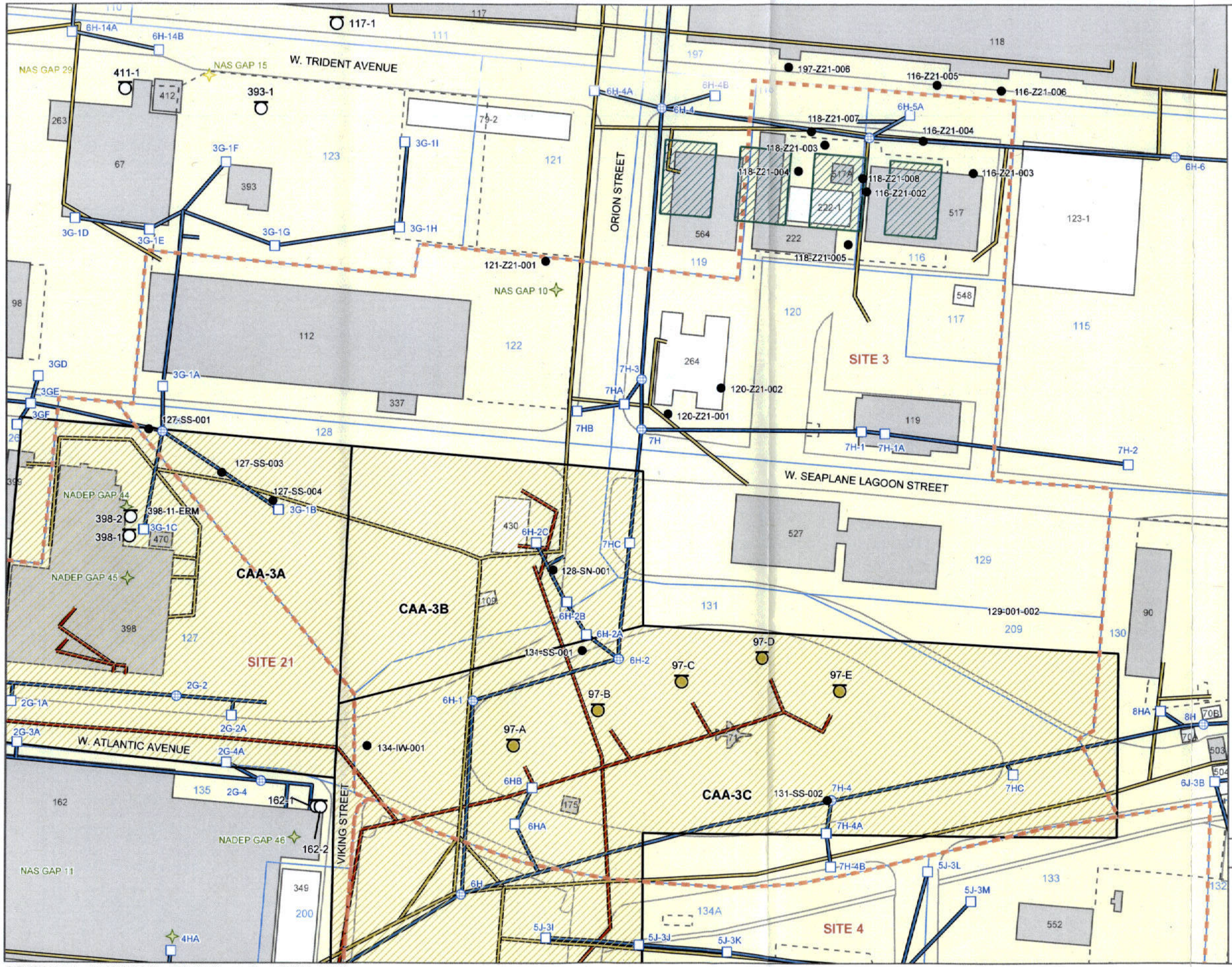

SAMPLING LOCATION

- Location analyzed for pesticides in soil

UNDERGROUND STORAGE TANK (UST)

- Present
- Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CORRECTIVE ACTION AREA (CAA)

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL BOUNDARY AND NUMBER

FORMER BUNKER (VISIBLE IN 1957 AERIAL PHOTO)

LAND COVER

BUILDING

- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
GAP = Generator accumulation point
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, 295 and 394 could not be located and are not included on this figure.

50 0 50 100 Feet

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FIGURE 5-9
SITE 3 SAMPLING LOCATIONS FOR PESTICIDES IN SOIL

Operable Unit 2B
Remedial Investigation Report

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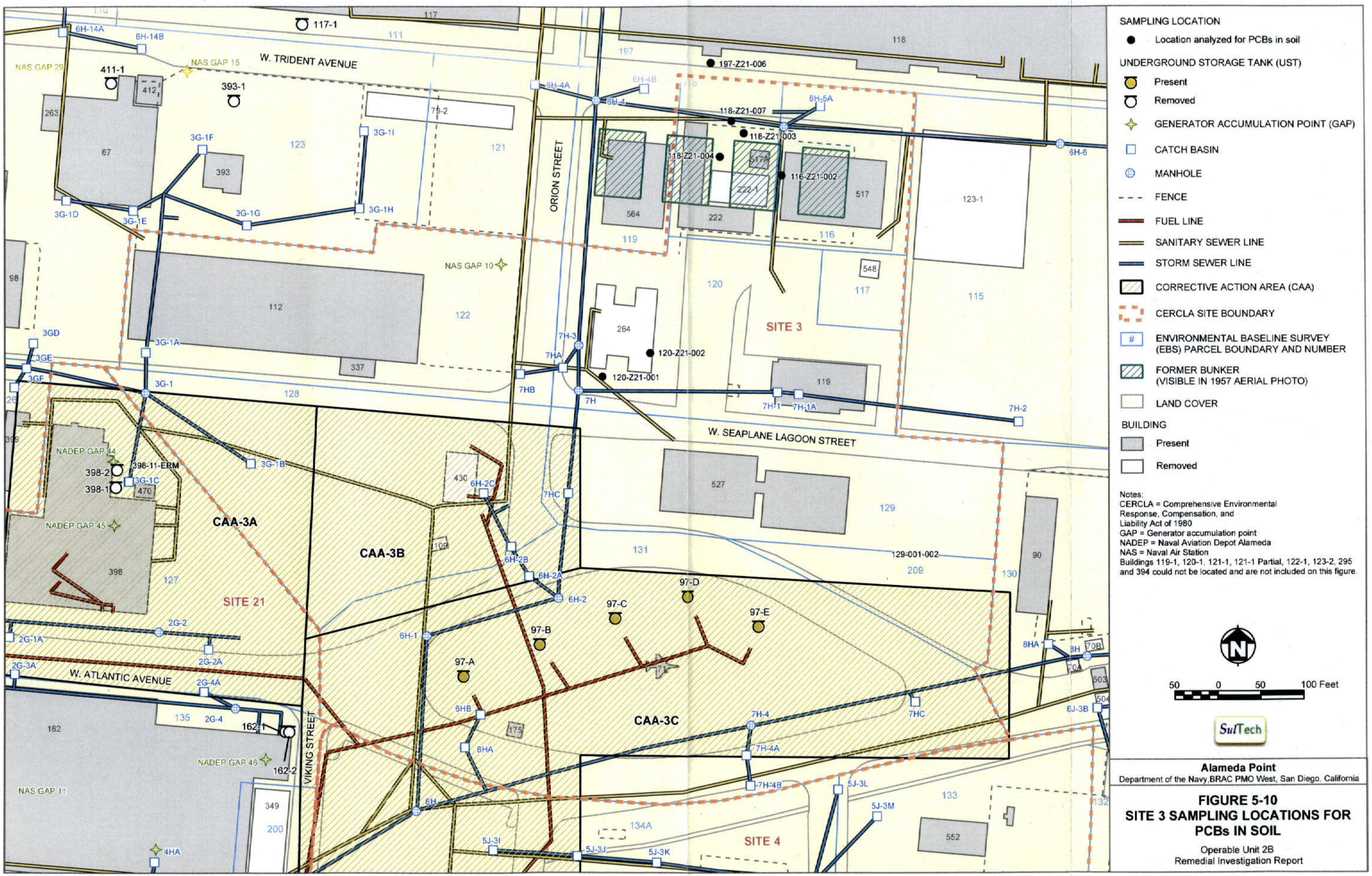

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FIGURE 5-10
SITE 3 SAMPLING LOCATIONS FOR PCBs IN SOIL

Operable Unit 2B
Remedial Investigation Report

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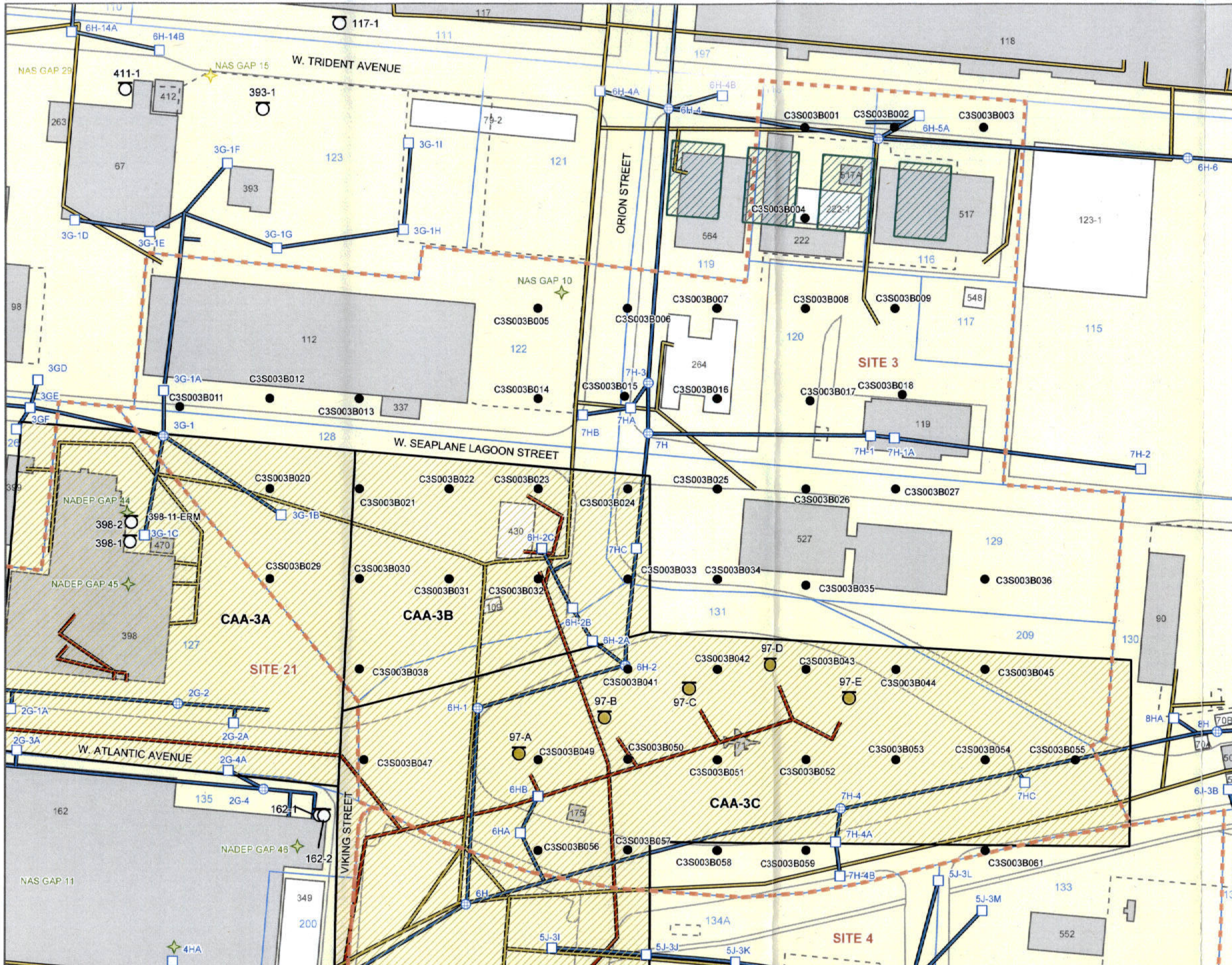

SAMPLING LOCATION

- Location analyzed for PAHs in soil

UNDERGROUND STORAGE TANK (UST)

- Present
- Removed
- GENERATOR ACCUMULATION POINT (GAP)
- CATCH BASIN
- MANHOLE
- FENCE
- FUEL LINE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CORRECTIVE ACTION AREA (CAA)
- CERCLA SITE BOUNDARY
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL BOUNDARY AND NUMBER
- FORMER BUNKER (VISIBLE IN 1957 AERIAL PHOTO)
- LAND COVER

BUILDING

- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
GAP = Generator accumulation point
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-1, 295 and 394 could not be located and are not included on this figure.

50 0 50 100 Feet

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FIGURE 5-11
SITE 3 SAMPLING LOCATIONS FOR PAHs IN SOIL

Operable Unit 2B
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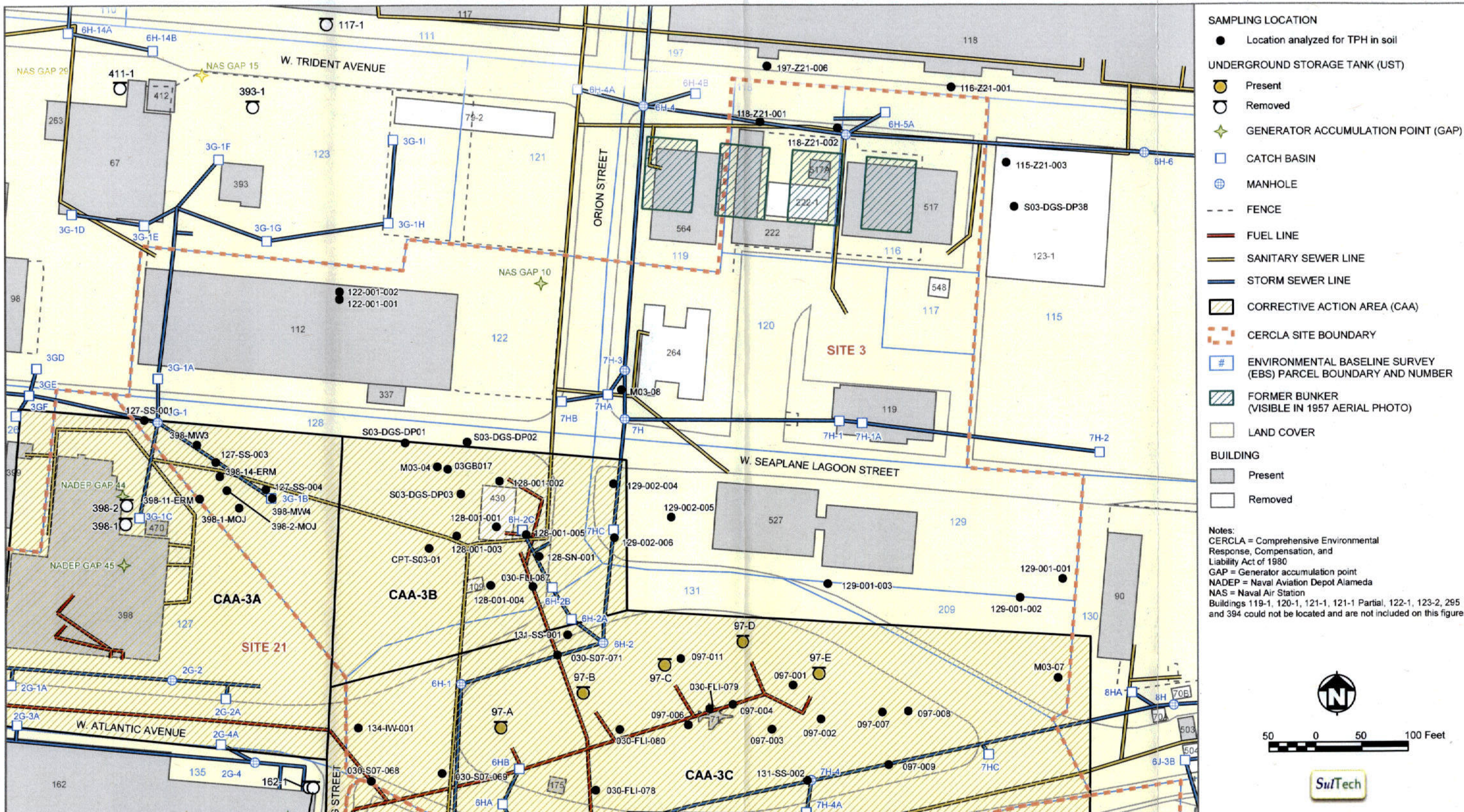

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FIGURE 5-12
SITE 3 SAMPLING LOCATIONS FOR TPH IN SOIL
Operable Unit 2B
Remedial Investigation Report

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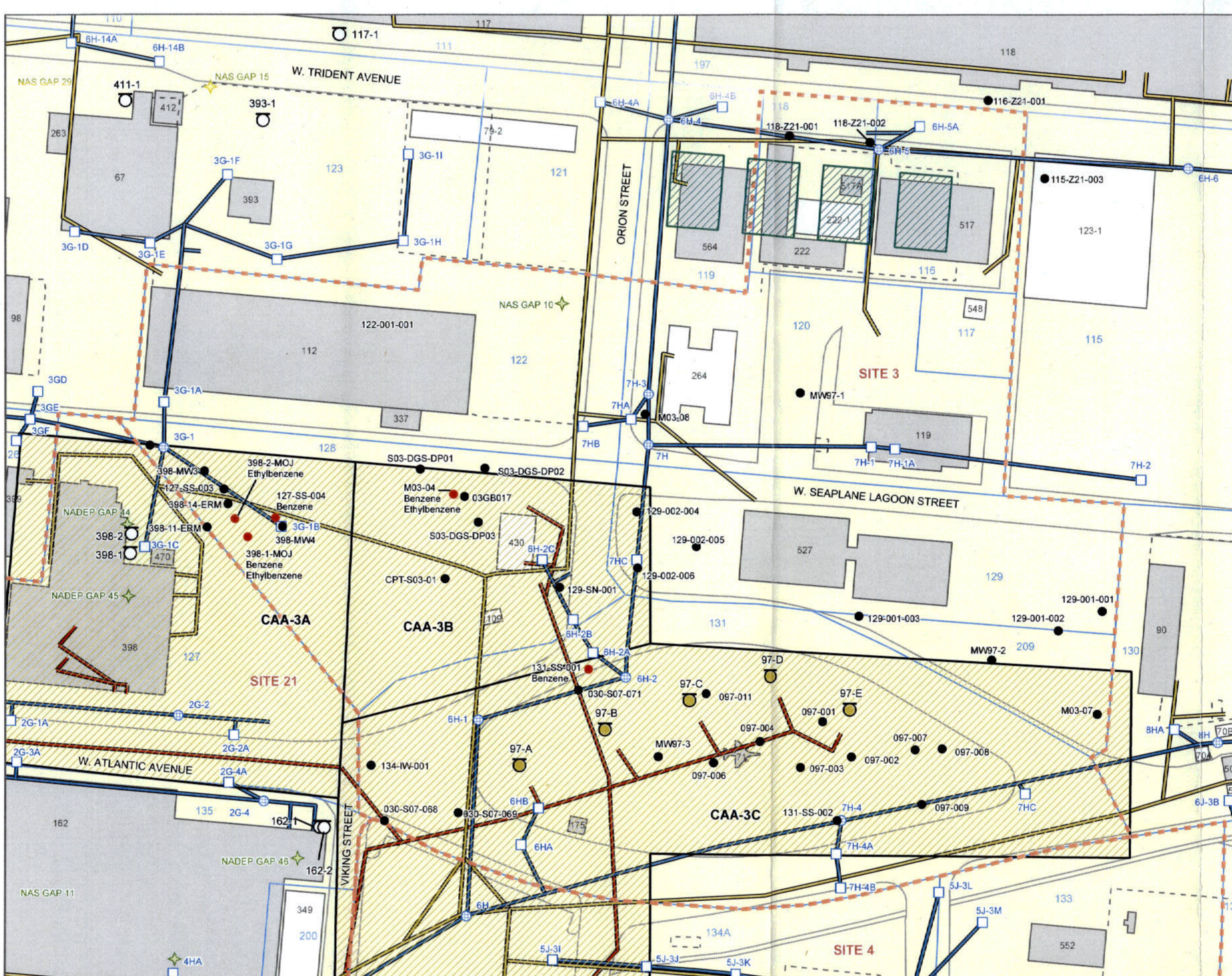

SAMPLING LOCATION

- VOCs in Site 3 soil exceeding PRGs
- VOCs in Site 3 soil not exceeding PRGs

UNDERGROUND STORAGE TANK (UST)

- Present
- Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CORRECTIVE ACTION AREA (CAA)

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL BOUNDARY AND NUMBER

FORMER BUNKER (VISIBLE IN 1957 AERIAL PHOTO)

LAND COVER

BUILDING

- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
GAP = Generator accumulation point
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, 295 and 394 could not be located and are not included on this figure.

50 0 50 100 Feet

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FIGURE 5-13
VOCs IN SITE 3 SOIL EXCEEDING PRGs

Operable Unit 2B
Remedial Investigation Report

04/21/2005 U:\almda_sa\do030\OU2B_RI\mxd\fig05-13_s03_voc_soil_above_prg.mxd TtEMI-SA T. Munley

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FIGURE 5-14
METALS IN SITE 3 SOIL EXCEEDING PRGs

Operable Unit 2B
Remedial Investigation Report

04/21/2005 U:\almda_sa\do030\OU2B_RI\mxd\fig05-14_s03_metals_soil_above_background.mxd TtEMI-SA T. Munley

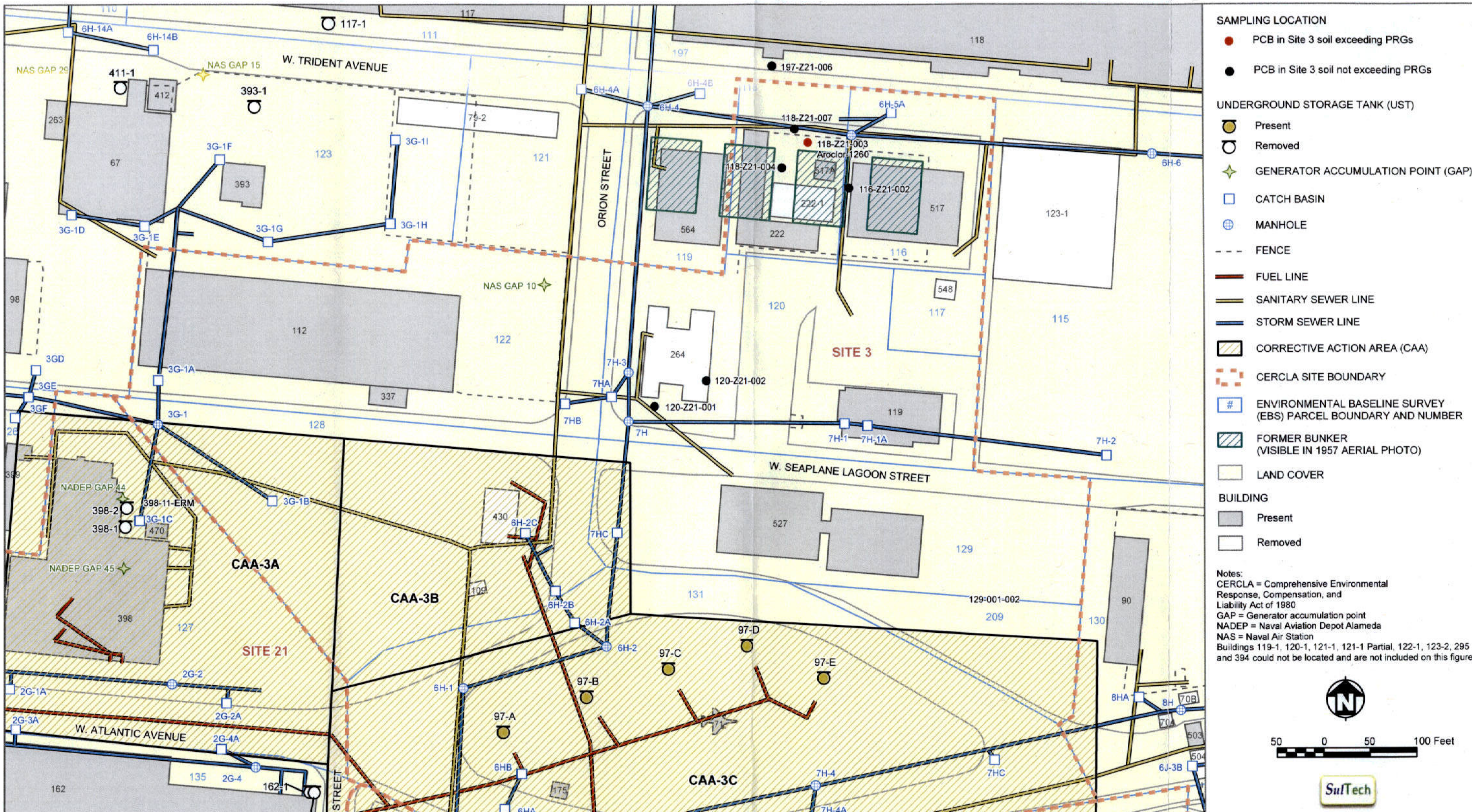

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FIGURE 5-15

PCBs IN SITE 3 SOIL EXCEEDING PRGs

Operable Unit 2B

Remedial Investigation Report

04/21/2005 U:\almda_sa\do030\OU2B_RI\mxd\fig05-15_s03_pcb_soil_above_prgmxd TtEMI-SA T. Munley

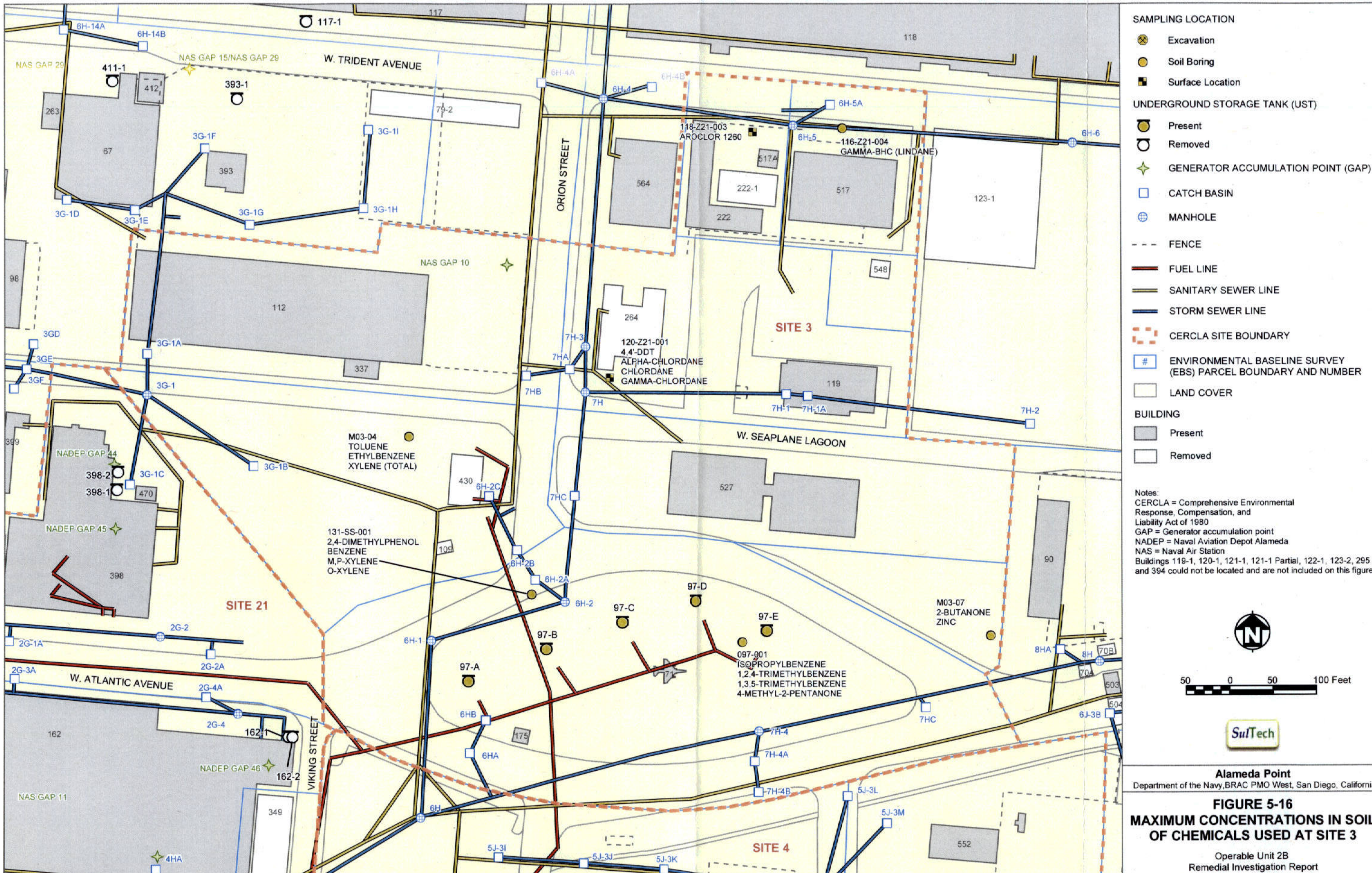

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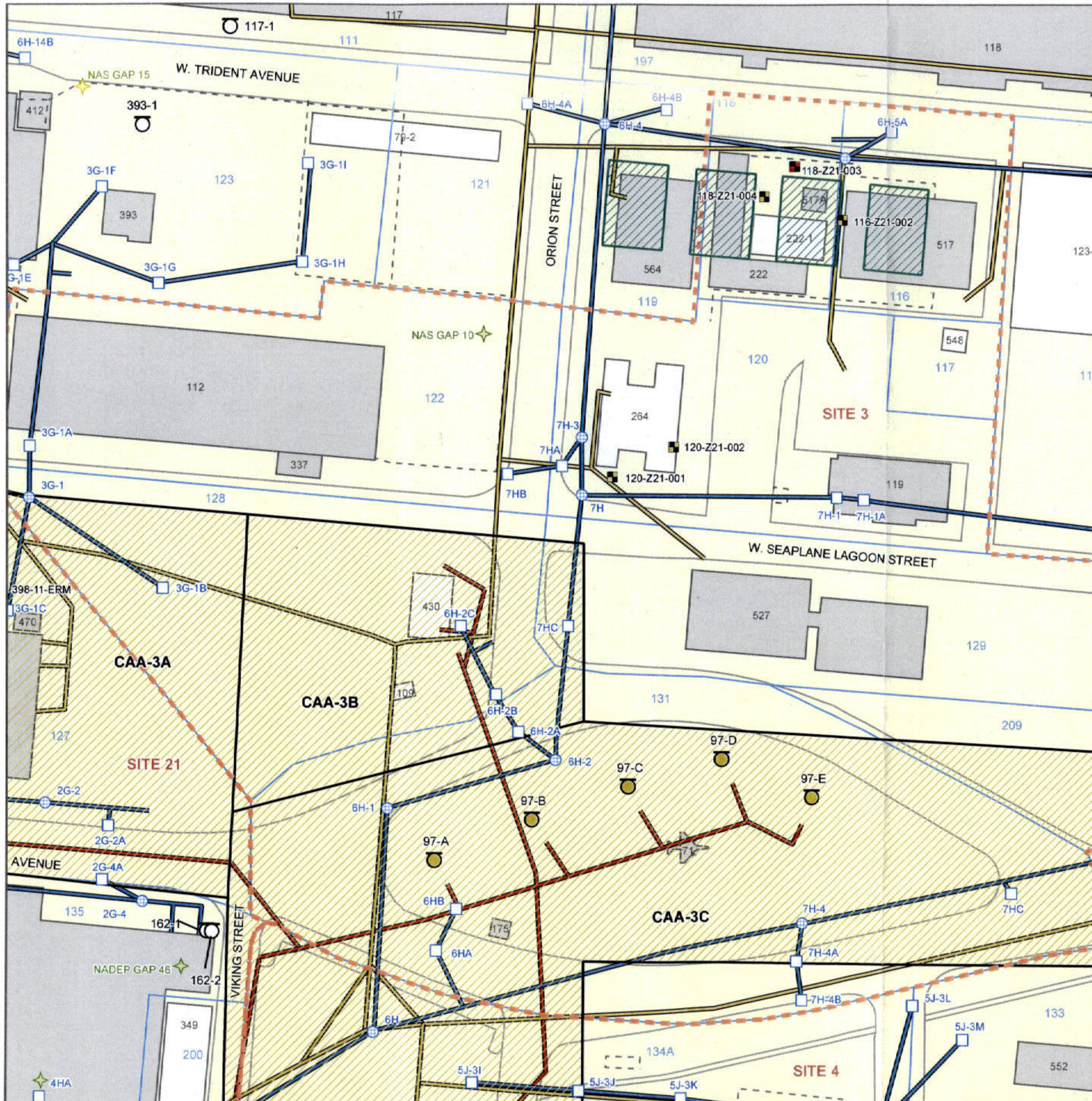
FIGURE 5-16
MAXIMUM CONCENTRATIONS IN SOIL OF CHEMICALS USED AT SITE 3

Operable Unit 2B
Remedial Investigation Report



Sampling Location	Sample Depth (feet)	Concentration (µg/kg)[1]	Qualifier
116-Z21-002	0.5-1.0	37	U
116-Z21-002*	0.5-1.0	9.5	J
116-Z21-003*	0.5-1.0	15	U
116-Z21-004	1.0-2.0	39	U
116-Z21-004	3.0-4.0	37	U
116-Z21-005	4.0-5.0	35	UJ
116-Z21-005	4.0-5.0	48	U
116-Z21-006	2.5-3.5	38	U
116-Z21-006	3.5-4.5	40	UJ
118-Z21-003*	0.5-1.0	**5200**	
118-Z21-004*	0.5-1.0	90	
118-Z21-005*	0.5-1.0	14	U
118-Z21-007	3.5-4.5	35	U
118-Z21-008	1.0-2.0	35	U
118-Z21-008	2.0-3.0	37	U
120-Z21-001	0.0-0.5	32	J
120-Z21-001*	0.0-0.5	29	U
120-Z21-002	0.0-0.5	39	
121-Z21-001	0.0-0.5	34	U
121-Z21-001*	0.0-0.5	13	U
127-SS-001	7.0-8.0	40	U
127-SS-003	3.0-3.5	36	U
127-SS-004	3.0-4.0	35	U
128-SN-001	8.0-9.5	40	U
131-SS-001	3.0-4.0	49	U
131-SS-002	10.0-11.0	42	U
134-IW-001	4.0-4.5	36	U
197-Z21-006	2.0-3.0	36	U
197-Z21-006	2.0-3.0	25	U

SAMPLING LOCATION
Red = Exceeds Screening Level[2]

Soil Boring
Surface Location

UNDERGROUND STORAGE TANK (UST)

Present
Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CORRECTIVE ACTION AREA (CAA)

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL BOUNDARY AND NUMBER

FORMER BUNKER (VISIBLE IN 1957 AERIAL PHOTO)

LAND COVER

BUILDING

Present
Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
GAP = Generator accumulation point
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, 295 and 394 could not be located and are not included on this figure.
1
2 Bold denotes "Exceeds screening level"
Risk based screening level is 220 µg/kg
* = Mobile Laboratory result

50 0 50 100 Feet

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FIGURE 5-17
SITE 3 CONCENTRATIONS OF AROCLOR-1260 IN SOIL

Operable Unit 2B
Remedial Investigation Report

03/31/2005 U:\almda_sa\do030\OU2B_RI\mxd\fig05-17_s03_pcb_soil.mxd TtEMI-SA T. Munley

Sampling Location	Sample Depth (feet)	Concentration (µg/kg)[1]	Qualifier
030-FLI-078	0.0-4.5	0.6	UJ
030-FLI-079	0.0-5.5	0.59	U
030-FLI-080	0.0-6.0	0.58	U
030-FLI-087	0.0-6.5	0.56	U
030-S07-068	0.0-9.5	11	U
030-S07-069	0.0-5.0	11	U
030-S07-071	0.0-5.5	2	J
03GB017	0.5-1.0	11	U
03GB017	2.5-3.0	10	U
03GB017	4.5-5.5	11	U
097-001	9.0-10.0	2900	U
097-002	9.0-10.0	5.6	U
097-003	8.0-9.0	6	U
097-004	9.0-10.0	8.7	U
097-006	8.0-9.0	6	U
097-007	9.0-10.0	9.1	U
097-008	9.0-10.0	8.8	U
097-009	9.0-10.0	8.3	U
097-011	6.0-7.0	6.1	U
115-Z21-003	5.0-6.0	12	U
115-Z21-003	5.0-6.0	6	U
116-Z21-001	4.0-4.5	7.9	U
118-Z21-001	4.0-4.5	6.2	U
118-Z21-002	4.0-4.5	7.9	U
127-SS-001	7.0-8.0	10	U
127-SS-003	3.0-3.5	5	U
127-SS-004	3.0-4.0	**750**	
128-SN-001	8.0-9.5	2000	U
129-001-001	4.0-5.0	12	U
129-001-001	4.0-5.0	8.2	U
129-001-002	4.0-4.5	6.7	U
129-001-003	4.0-5.0	7.1	U
129-002-004	4.0-5.0	46	
129-002-004	4.0-5.0	30	
129-002-005	4.0-5.0	8.8	U
129-002-006	4.0-5.0	5.5	J
131-SS-001	3.0-4.0	**12000**	
131-SS-002	10.0-11.0	10	U
134-IW-001	4.0-4.5	11	U
134-IW-001	4.0-4.5	10	U
398-11-ERM	5	100	
398-14-ERM	5	290	
398-1-MOJ	6	**900**	
398-2-MOJ	6	1000	U
398-MW3	4	11000	U
398-MW4	4	11000	U
CPT-S03-01	0.0-1.0	11	U
CPT-S03-01	2.5-3.5	1300	U
CPT-S03-01	5.0-6.0	6200	U
M03-04	1.0-2.0	11	U
M03-04	10.0-11.0	14	U
M03-04	2.5-3.5	**7500**	J
M03-04	5.0-6.0	1400	U
M03-07	1.0-2.0	16	U
M03-07	2.5-3.5	16	U
M03-07	4.5-5.5	12	U
M03-08	1.0-2.0	11	U
M03-08	2.5-3.5	13	U
M03-08	5.0-6.0	14	U
MW97-1	11.5-12.0	6	U
MW97-1	2.5-3.0	6	U
MW97-1	5.0-5.5	6	U
MW97-1	8.0-8.5	10	U
MW97-2	11.5-12.0	6	U
MW97-2	14.5-15.0	5	U
MW97-2	2.0-2.5	6	U
MW97-2	5.0-5.5	9	U
MW97-2	8.0-8.5	6	U
MW97-3	11.5-12.0	6	U
MW97-3	14.5-15.0	6	U
MW97-3	2.0-2.5	5	U
MW97-3	5.0-5.5	7	U
MW97-3	8.0-8.5	9	U
S03-DGS-DP01	5.0-5.5	2	U
S03-DGS-DP02	5.5-6.0	2	U
S03-DGS-DP03	5.0-5.5	21	

SAMPLING LOCATION

- Direct push
- Excavation
- Monitoring Well
- Soil Boring
- Soil Punch

UNDERGROUND STORAGE TANK (UST)

- Present
- Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CORRECTIVE ACTION AREA (CAA)

CERCLA SITE BOUNDARY

\# ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL BOUNDARY AND NUMBER

FORMER BUNKER (VISIBLE IN 1957 AERIAL PHOTO)

LAND COVER

BUILDING

- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
GAP = Generator accumulation point
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, 295 and 394 could not be located and are not included on this figure.

[1] Bold denotes "exceeds screening level"
[2] Risk based screening level is 600 µg/kg

N

60 0 60 120 Feet

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FIGURE 5-18
SITE 3 CONCENTRATIONS FOR BENZENE IN SOIL

Operable Unit 2B
Remedial Investigation Report

4/18/2005 U:\almda_sa\do030\OU2B_RI\mxd\fig05-18_s03_benzene_soil.mxd TtEMI-SA T. Munley

Sampling Location	Sample Depth (feet)	Concentration (mg/kg)[1]	Qualifier
030-S07-068	0.0-9.5	14400	
030-S07-069	0.0-5.0	14400	
030-S07-071	0.0-5.5	7800	
097-004	9.0-10.0	**43200**	
097-011	6.0-7.0	8760	
097-006	8.0-9.0	8560	
097-001	9.0-10.0	9470	
097-002	9.0-10.0	19200	
097-003	8.0-9.0	10200	
097-007	9.0-10.0	**44000**	
097-008	9.0-10.0	**43900**	
097-009	9.0-10.0	**40800**	
115-Z21-003	5.0-6.0	20400	J
116-Z21-004	1.0-2.0	**35400**	
116-Z21-004	3.0-4.0	**39700**	
116-Z21-005	4.0-5.0	**34600**	
116-Z21-005	4.0-5.0	**39200**	
116-Z21-006	2.5-3.5	**30500**	
116-Z21-006	3.5-4.5	12300	
118-Z21-002	0.5-1.0	**32400**	J
118-Z21-007	1.0-2.0	7030	
118-Z21-007	3.5-4.5	6210	
118-Z21-008	1.0-2.0	16600	
118-Z21-008	2.0-3.0	9240	
122-001-001	0.5-1.0	10100	J
122-002-004	1.0-1.5	6840	J
129-001-001	0.5-1.0	10700	
129-002-004	1.0-1.5	11000	
129-001-001	4.5-5.0	**24100**	
129-002-004	4.0-5.0	19000	
129-003-007	3.5-4.0	21100	
129-003-008	3.5-4.0	**37800**	
134-IW-001	4.0-4.5	7410	
CPT-S03-01	0.0-1.0	**34300**	J
CPT-S03-01	2.5-3.5	10700	J
CPT-S03-01	5.0-6.0	7300	J
M03-04	1.0-2.0	7630	
M03-04	2.5-3.5	11300	
M03-04	5.0-6.0	9470	
M03-04	10.0-11.0	**25600**	
M03-07	1.0-2.0	17500	
M03-07	2.5-3.5	**30700**	
M03-07	4.5-5.5	7430	
M03-08	1.0-2.0	9660	
M03-08	2.5-3.5	14100	
M03-08	5.0-6.0	21300	
MW97-1	1.5-2.0	8190	
MW97-1	10.5-11.0	6980	
MW97-1	14.0-14.5	8340	
MW97-1	3.0-3.5	7050	
MW97-1	7.0-7.5	**25600**	
MW97-2	1.0-1.5	7790	
MW97-2	11.0-11.5	9460	
MW97-2	14.0-14.5	13200	
MW97-2	3.5-4.0	**31200**	
MW97-2	7.0-7.5	**33300**	
MW97-3	0.5-1.0	13600	
MW97-3	10.5-11.0	9660	
MW97-3	14.0-14.5	13400	
MW97-3	3.5-4.0	15400	
MW97-3	7.0-7.5	8400	

SAMPLING LOCATION
Red = Exceeds Screening Level[2]

- Direct Push
- Excavation
- Soil Boring
- Surface Location
- Soil Punch

UNDERGROUND STORAGE TANK (UST)

- Present
- Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CORRECTIVE ACTION AREA (CAA)

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL BOUNDARY AND NUMBER

FORMER BUNKER (VISIBLE IN 1957 AERIAL PHOTO)

LAND COVER

BUILDING

- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
GAP = Generator accumulation point
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, 295 and 394 could not be located and are not included on this figure.

[1] Bold denotes "exceeds screening level"
[2] Screening level based on maxium ambient concentration of 27,900 mg/kg for Iron

60 0 60 120 Feet

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FIGURE 5-19
SITE 3 CONCENTRATIONS OF IRON IN SOIL

Operable Unit 2B
Remedial Investigation Report

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Sample Location	Sample Depth (feet)	Concentration[1] (mg/kg)	Qualifier
030-S07-068	0 - 9.5	17.2	J
030-S07-069	0 - 5	17.2	J
030-S07-071	0 - 5.5	7.3	J
097-001	9 - 10	7.7	
097-002	9 - 10	68.2	
097-003	8 - 9	19.1	
097-004	9 - 10	46.5	
097-006	8 - 9	8	
097-007	9 - 10	34.1	
097-008	9 - 10	22.8	
097-009	9 - 10	20.5	
097-011	6 - 7	1.8	
115-Z21-003	0.5 - 1	60.5	
115-Z21-003	5 - 6	57.2	
116-Z21-001	0.5 - 1	8.4	
116-Z21-001	4 - 4.5	30	
116-Z21-004	1 - 2	0.19	U
116-Z21-004	3 - 4	**613**	
116-Z21-005	4 - 5	0.17	U
116-Z21-005	4 - 5	55.1	
116-Z21-006	2.5 - 3.5	0.18	U
116-Z21-006	3.5 - 4.5	1.4	
118-Z21-001	0.5 - 1	26	
118-Z21-001	4 - 4.5	12	
118-Z21-002	0.5 - 1	**474**	J
118-Z21-002	4 - 4.5	**3000**	
118-Z21-007	1 - 2	12.3	
118-Z21-007	3.5 - 4.5	2.7	
118-Z21-008	1 - 2	34	
118-Z21-008	2 - 3	3.1	
122-001-001	0.5 - 1	2.8	
122-001-001	0.5 - 1	3.5	
122-001-002	1 - 1.5	1.8	
122-002-004	1 - 1.5	2.8	
122-002-004	1 - 1.5	4	
127-SS-001	7 - 8	25	U
127-SS-003	3 - 3.5	2.2	
127-SS-004	3 - 4	25	U
128-SN-001	8 - 9.5	25	U
129-001-001	0.5 - 1	6.7	
129-001-001	0.5 - 1	3	
129-001-001	4 - 5	61.3	
129-001-001	4 - 5	25	
129-001-002	0.5 - 1	5.9	
129-001-002	4 - 4.5	**1600**	
129-001-003	0.5 - 1.5	2.2	
129-001-003	4 - 5	56	
129-002-004	1 - 1.5	2.2	
129-002-004	1 - 1.5	3.1	
129-002-004	4 - 5	6.2	
129-002-004	4 - 5	6.8	
129-002-005	0.5 - 1	5.3	
129-002-005	4 - 5	15	
129-002-006	1 - 1.5	2.8	
129-002-006	4 - 5	14	
129-003-007	3.5 - 4	7.7	J
129-003-008	3.5 - 4	30.2	J
131-SS-001	3 - 4	25	U
131-SS-002	10 - 11	66	
134-IW-001	4 - 4.5	3.8	J
134-IW-001	4 - 4.5	25	U
197-Z21-006	2 - 3	3	
197-Z21-006	2 - 3	3.6	
CPT-S03-01	0 - 1	3.2	J
CPT-S03-01	2.5 - 3.5	6.3	
CPT-S03-01	5 - 6	52.2	J
M03-04	1 - 2	9.8	
M03-04	10 - 11	26.8	
M03-04	2.5 - 3.5	7.2	
M03-04	5 - 6	5.9	
M03-07	1 - 2	124	
M03-07	2.5 - 3.5	**2380**	
M03-07	4.5 - 5.5	5.4	
M03-08	2 - 2	1.7	
M03-08	2.5 - 3.5	8.2	
M03-08	5 - 6	33.1	
MW97-1	1.5 - 2	5.4	U
MW97-1	10.5 - 11	6.1	U
MW97-1	14 - 14.5	6	U
MW97-1	3 - 3.5	5.8	U
MW97-1	7 - 7.5	44	
MW97-2	1 - 1.5	5.5	U
MW97-2	11 - 11.5	5.9	U
MW97-2	14 -14.5	6.2	U
MW97-2	3.5 - 4	59	
MW97-2	7 - 7.5	100	

SAMPLING LOCATION
Red = Exceeds Screening Level[2]

- Direct-Push
- Excavation
- Soil Boring
- Surface Location

UNDERGROUND STORAGE TANK (UST)

- Present
- Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL BOUNDARY AND NUMBER

LAND COVER

BUILDING

- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
GAP = Generator accumulation point
J = Estimated
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
U = Non-detected
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, 295 and 394 could not be located and are not included on this figure.

[1]Bold denotes "exceeds screening level."
[2]Screening level based on maximum ambient concentration of 165 mg/kg.

50 0 50 100 Feet

N

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FIGURE 5-20 (1 OF 2)
SITE 3 CONCENTRATIONS OF LEAD IN SOIL

Operable Unit 2B
Remedial Investigation Report

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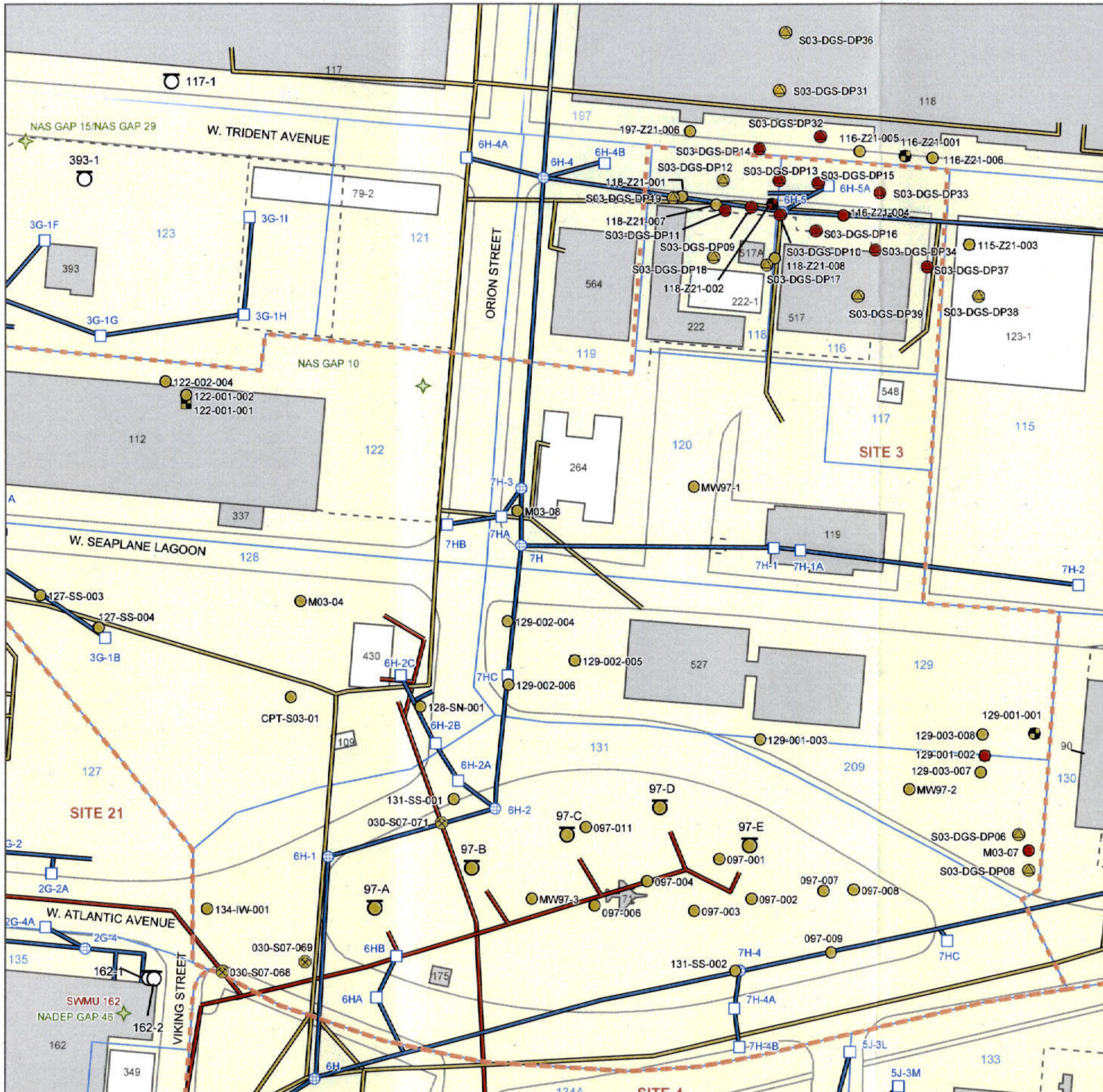

Sample Location	Sample Depth (feet)	Concentration[1] (mg/kg)	Qualifier
MW97-3	0.5 - 1	22	
MW97-3	10.5 - 11	5.8	U
MW97-3	15 - 14.5	6	U
MW97-3	3.5 - 4	9.8	
MW97-3	7 - 7.5	27	
S03-DGS-DP06	0.5 - 1	9.4	J
S03-DGS-DP06	2.5 - 3	5.7	J
S03-DGS-DP06	4.5 - 5	7.7	J
S03-DGS-DP08	0.5 - 1	0.27	UJ
S03-DGS-DP08	2.5 - 3	9.3	J
S03-DGS-DP08	4.5 - 5	1.1	UJ
S03-DGS-DP09	0.5 - 1	49.1	J
S03-DGS-DP09	3.5 - 4	49.7	J
S03-DGS-DP09	5.5 - 6	**955**	J
S03-DGS-DP10	0.5 - 1	80.3	J
S03-DGS-DP10	3.5 - 4	**446**	J
S03-DGS-DP10	5.5 - 6	35.4	J
S03-DGS-DP11	1 - 1.5	42.3	J
S03-DGS-DP11	4 - 4.5	56	J
S03-DGS-DP11	6 - 6.5	**1330**	J
S03-DGS-DP12	4 - 4.5	4	J
S03-DGS-DP13	1 - 1.5	17.4	J
S03-DGS-DP13	4 - 4.5	**1300**	J
S03-DGS-DP13	6 - 6.5	**1780**	J
S03-DGS-DP14	1 - 1.5	12	J
S03-DGS-DP14	4 - 4.5	13.5	J
S03-DGS-DP14	6 - 6.5	**1030**	J
S03-DGS-DP15	1 - 1.5	**511**	J
S03-DGS-DP15	4 - 4.5	**3870**	J
S03-DGS-DP15	6 - 6.5	**13700**	J
S03-DGS-DP16	1 - 1.5	**229**	
S03-DGS-DP16	4 - 4.5	137	
S03-DGS-DP16	6 - 6.5	**705**	
S03-DGS-DP17	1 - 1.5	2.9	
S03-DGS-DP17	4 - 4.5	52.3	
S03-DGS-DP17	6 - 6.5	40.6	
S03-DGS-DP18	4 - 4.5	29.8	
S03-DGS-DP18	6 - 6.5	85.3	
S03-DGS-DP19	4 - 4.5	12.5	J
S03-DGS-DP19	6 - 6.5	61.8	J
S03-DGS-DP31	5.5 - 6	20.6	
S03-DGS-DP32	3.5 - 4	2.7	UJ
S03-DGS-DP32	5.5 - 6	**195**	
S03-DGS-DP33	0.5 - 1	24	
S03-DGS-DP33	3.5 - 4	17.1	
S03-DGS-DP33	5.5 - 6	**198**	
S03-DGS-DP34	0.5 - 1	47.6	
S03-DGS-DP34	3.5 - 4	8.6	
S03-DGS-DP34	5.5 - 6	**1480**	
S03-DGS-DP36	6 - 6.5	11	
S03-DGS-DP37	6 - 6.5	**533**	
S03-DGS-DP38	6 - 6.5	18.6	
S03-DGS-DP39	6 - 6.5	14.8	

SAMPLING LOCATION
Red = Exceeds Screening Level[2]

- Direct-Push
- Excavation
- Soil Boring
- Surface Location

UNDERGROUND STORAGE TANK (UST)

- Present
- Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL BOUNDARY AND NUMBER

LAND COVER

BUILDING

- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
GAP = Generator accumulation point
J = Estimated
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
U = Non-detected
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, 295 and 394 could not be located and are not included on this figure.

[1]Bold denotes "exceeds screening level."
[2]Screening level based on maximum ambient concentration of 165 mg/kg.

50 0 50 100 Feet

N

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FIGURE 5-20 (2 OF 2) SITE 3 CONCENTRATIONS OF LEAD IN SOIL

Operable Unit 2B
Remedial Investigation Report

04/21/2005 U:\almda_sa\do030\OU2B_RI\mxd\fig05-20-2_s03_soil_lead.mxd TtEMI-SA T. Munley

Point Name	Sample Depth (feet)	B(a)P EQ[1] (mg/kg)
C3S003B001	0 - 0.5	0.086
	0.5 - 2	0.069
	2 - 4	0.009
	4 - 8	0.131
C3S003B002	0 - 0.5	0.116
	0.5 - 2	0.142
	2 - 4	0.404
	4 - 8	**19.118**
C3S003B003	0 - 0.5	0.038
	0.5 - 2	0.021
	2 - 4	0.035
	4 - 8	0.139
C3S003B004	0 - 0.5	0.014
	0.5 - 2	0.002
	2 - 4	0.002
	4 - 8	0.083
C3S003B005	0 - 0.5	ND
	0.5 - 2	0.002
	2 - 4	0.007
	4 - 8	0.332
C3S003B006	0 - 0.5	0.002
	0.5 - 2	0.016
	2 - 4	0.039
	4 - 8	0.051
C3S003B007	0 - 0.5	0.103
	0.5 - 2	0.064
	2 - 4	0.006
	4 - 8	0.539
C3S003B008	0 - 0.5	0.003
	0.5 - 2	ND
	2 - 4	0.153
	4 - 8	0.079
C3S003B009	0 - 0.5	ND
	0.5 - 2	0.115
	2 - 4	0.105
	4 - 8	0.110
C3S003B011	0 - 0.5	0.001
	0.5 - 2	0.001
	2 - 4	0.001
	4 - 8	0.039
C3S003B012	0 - 0.5	0.004
	0.5 - 2	0.001
	2 - 4	0.002
	4 - 8	0.004
C3S003B013	0 - 0.5	0.006
	0.5 - 2	0.009
	2 - 4	0.052
	4 - 8	0.066
C3S003B014	0 - 0.5	ND
	0.5 - 2	0.002
	2 - 4	0.005
	4 - 8	0.441
C3S003B015	0 - 0.5	0.026
	0.5 - 2	0.052
	2 - 4	0.003
	4 - 8	0.029
C3S003B016	0 - 0.5	0.042
	0.5 - 2	0.061
	2 - 4	0.005
	4 - 8	0.069
C3S003B017	0 - 0.5	0.023
	0.5 - 2	0.008
	2 - 4	0.045
	4 - 8	0.030
C3S003B018	0 - 0.5	0.131
	0.5 - 2	0.101
	2 - 4	0.229
	4 - 8	**0.884**
C3S003B020	0 - 0.5	0.356
	0.5 - 2	0.003
	2 - 4	0.002
	4 - 8	0.082
C3S003B021	0 - 0.5	0.003
	0.5 - 2	0.016
	2 - 4	0.010
	4 - 8	0.018
C3S003B022	0 - 0.5	0.002
	0.5 - 2	0.023
	2 - 4	0.294
	4 - 8	0.057
C3S003B023	0 - 0.5	ND
	0.5 - 2	ND
	2 - 4	0.000
	4 - 8	0.020
C3S003B024	0 - 0.5	ND
	0.5 - 2	0.019
	2 - 4	0.010
	4 - 8	0.025

SAMPLING LOCATION
Red = Exceeds Screening Level[2]

Soil Boring

UNDERGROUND STORAGE TANK (UST)

Present

Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL BOUNDARY AND NUMBER

LAND COVER

BUILDING

Present

Removed

Notes:
B(a)P EQ = Benzo(a)pyrene equivalent
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
EQ = Equivalent
GAP = Generator accumulation point
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
ND = Not determined, all PAHs were nondetect
PAH = Polynuclear aromatic hydrocarbon
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, 295 and 394 could not be located and are not included on this figure.

[1]Bold denotes "exceeds screening level."
[2]Screening level based on 0.62 mg/kg

50 0 50 100 Feet

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FIGURE 5-21 (1 OF 3) SITE 3 CONCENTRATIONS OF PAHs IN SOIL

Operable Unit 2B
Remedial Investigation Report

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Point Name	Sample Depth (feet)	B(a)P EQ[1] (mg/kg)
C3S003B025	0 - 0.5	0.028
	0.5 - 2	0.063
	2 - 4	0.120
	4 - 8	0.042
C3S003B026	0 - 0.5	0.086
	0.5 - 2	0.056
	2 - 4	0.005
	4 - 8	0.258
C3S003B027	0 - 0.5	0.018
	0.5 - 2	0.005
	2 - 4	0.059
	4 - 8	0.031
C3S003B029	0 - 0.5	0.022
	0.5 - 2	0.001
	2 - 4	0.000
	4 - 8	0.025
C3S003B030	0 - 0.5	0.005
	0.5 - 2	0.039
	2 - 4	0.184
C3S003B031	0 - 0.5	0.048
	0.5 - 2	0.212
	2 - 4	0.080
	4 - 8	0.041
C3S003B032	0 - 0.5	0.016
	0.5 - 2	0.018
	2 - 4	**0.781**
	4 - 8	0.102
C3S003B033	0 - 0.5	0.018
	0.5 - 2	0.315
	2 - 4	0.061
	4 - 8	0.135
C3S003B034	0 - 0.5	0.002
	0.5 - 2	0.026
	2 - 4	0.008
	4 - 8	0.145
C3S003B035	0 - 0.5	0.085
	0.5 - 2	0.114
	2 - 4	0.200
	4 - 8	0.329
C3S003B036	0 - 0.5	ND
	0.5 - 2	ND
	2 - 4	0.003
	4 - 8	0.521
C3S003B038	0 - 0.5	0.114
	0.5 - 2	0.253
	2 - 4	0.091
	4 - 8	0.046
C3S003B041	0 - 0.5	0.201
	0.5 - 2	0.236
	2 - 4	**0.929**
	4 - 8	**0.632**
C3S003B042	0 - 0.5	0.195
	0.5 - 2	0.153
	2 - 4	0.018
	4 - 8	0.020
C3S003B043	0 - 0.5	**3.652**
	0.5 - 2	**15.330**
	2 - 4	**4.931**
	4 - 8	0.038
C3S003B044	0 - 0.5	0.004
	0.5 - 2	0.001
	2 - 4	0.001
	4 - 8	0.548
C3S003B045	0 - 0.5	ND
	0.5 - 2	ND
	2 - 4	0.005
	4 - 8	0.314
C3S003B047	0 - 0.5	0.028
	0.5 - 2	0.043
	2 - 4	0.002
	4 - 8	0.040
C3S003B049	0 - 0.5	0.091
	0.5 - 2	**0.808**
	2 - 4	0.301
	4 - 8	0.323
C3S003B050	0 - 0.5	0.051
	0.5 - 2	**0.969**
	2 - 4	**0.767**
	4 - 8	0.469
C3S003B051	0 - 0.5	0.088
	0.5 - 2	0.097
	2 - 4	0.160
	4 - 8	0.397
C3S003B052	0 - 0.5	0.075
	0.5 - 2	0.067
	2 - 4	0.067
	4 - 8	0.336

SAMPLING LOCATION
Red = Exceeds Screening Level[2]

Soil Boring

UNDERGROUND STORAGE TANK (UST)

Present

Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL BOUNDARY AND NUMBER

LAND COVER

BUILDING

Present

Removed

Notes:
B(a)P EQ = Benzo(a)pyrene equivalent
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
EQ = Equivalent
GAP = Generator accumulation point
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
ND = Not determined, all PAHs were nondetect
PAH = Polynuclear aromatic hydrocarbon
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, 295 and 394 could not be located and are not included on this figure.

[1]Bold denotes "exceeds screening level."
[2]Screening level based on 0.62 mg/kg

50 0 50 100 Feet

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FIGURE 5-21 (2 OF 3)
SITE 3 CONCENTRATIONS OF PAHs IN SOIL

Operable Unit 2B
Remedial Investigation Report

04/18/2005 U:\almda_sa\dc030\OU2B_RI\mxd\fig05-21-2_s03_pah_conc.mxd TtEMI-SA T. Munley

Point Name	Sample Depth (feet)	B(a)P EQ[1] (mg/kg)
C3S003B053	0 - 0.5	0.172
	0.5 - 2	0.172
	2 - 4	0.301
	4 - 8	0.582
C3S003B054	0 - 0.5	0.115
	0.5 - 2	0.142
	2 - 4	0.227
	4 - 8	0.407
C3S003B055	0 - 0.5	0.005
	0.5 - 2	0.001
	2 - 4	0.003
	4 - 8	0.089
C3S003B056	0 - 0.5	0.070
	0.5 - 2	0.080
	2 - 4	0.050
	4 - 8	0.038
C3S003B057	0 - 0.5	0.060
	0.5 - 2	0.001
	2 - 4	**0.639**
	4 - 8	**0.969**
C3S003B058	0 - 0.5	0.003
	0.5 - 2	0.099
	2 - 4	**1.127**
	4 - 8	0.604
C3S003B059	0 - 0.5	0.005
	0.5 - 2	0.000
	2 - 4	0.002
	4 - 8	0.108
C3S003B061	0 - 0.5	0.046
	0.5 - 2	0.351
	2 - 4	0.076

SAMPLING LOCATION
Red = Exceeds Screening Level[2]

Soil Boring

UNDERGROUND STORAGE TANK (UST)

Present

Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL BOUNDARY AND NUMBER

LAND COVER

BUILDING

Present

Removed

Notes:
B(a)P EQ = Benzo(a)pyrene equivalent
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
EQ = Equivalent
GAP = Generator accumulation point
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
ND = Not determined, all PAHs were nondetect
PAH = Polynuclear aromatic hydrocarbon
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, 295 and 394 could not be located and are not included on this figure.

[1] Bold denotes "exceeds screening level."
[2] Screening level based on 0.62 mg/kg

50 0 50 100 Feet

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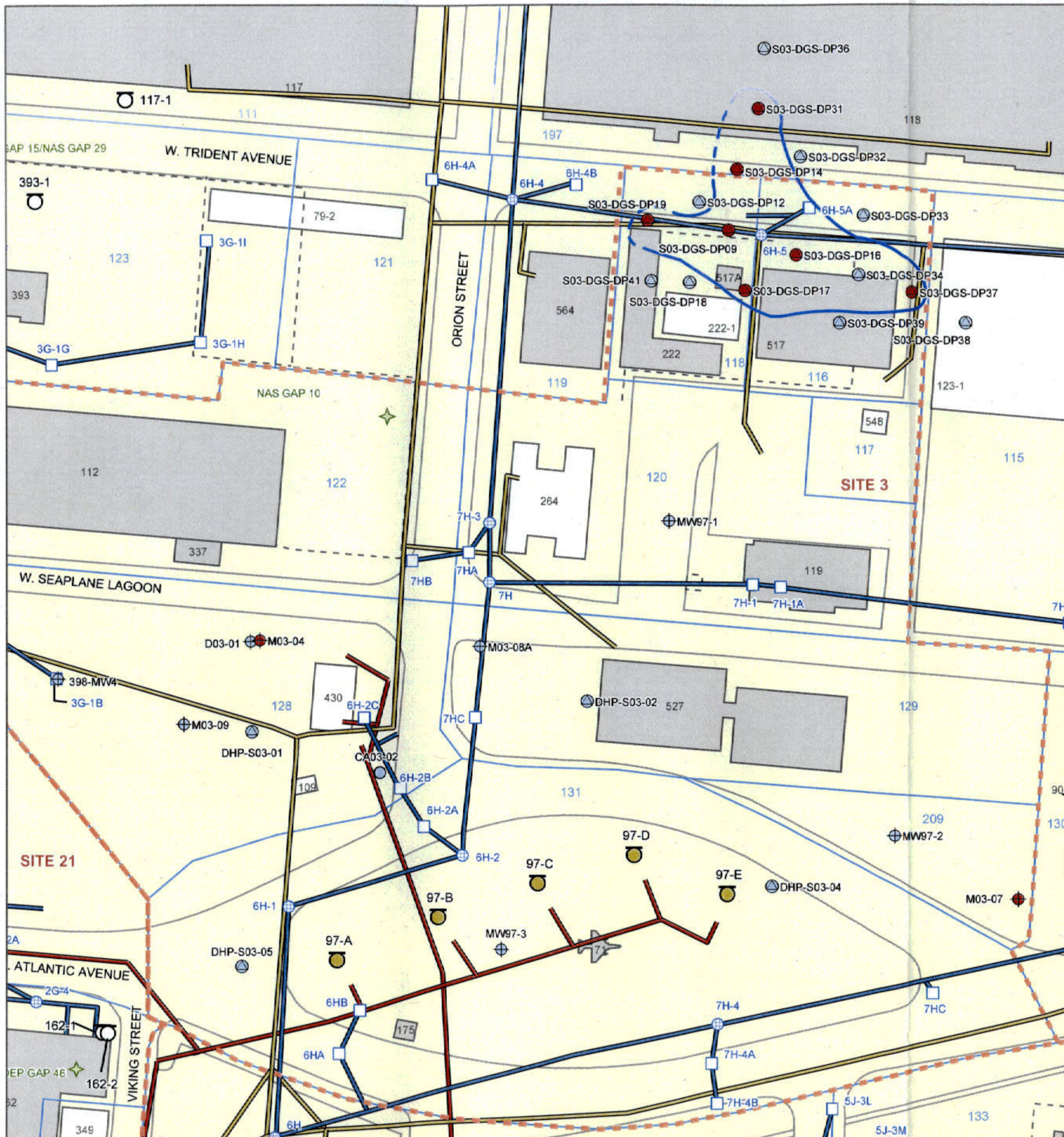
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 5-21 (3 OF 3)
SITE 3 CONCENTRATIONS OF PAHs IN SOIL

Operable Unit 2B
Remedial Investigation Report

04/18/2005 U:\almda_sa\do030\OU2B_RI\mxd\fig05-21-3_s03_pah_conc.mxd TtEMI-SA T. Munley

Continue



Point Name	Sample Date	Depth Interval	Concentration[1] (ug/L)	Qualifier
398-MW4	6/20/2002	2.85 - 12.85	0.18	J
398-MW4	12/10/2002	2.85 - 12.85	0.38	U
CA03-02	4/26/2000	3 - 8	7.3	
D03-01	12/14/1994	49.5 - 59.5	20	U
D03-01	2/16/1995	49.5 - 59.5	5	U
D03-01	6/8/1995	49.5 - 59.5	6.5	U
D03-01	8/4/1995	49.5 - 59.5	5.5	U
D03-01	7/3/2002	49.5 - 59.5	0.21	UJ
D03-01	12/10/2002	49.5 - 59.5	0.5	U
DHP-S03-01	9/6/1994	31.4	24	UJ
DHP-S03-02	8/5/1994	34	6	U
DHP-S03-04	8/5/1994	22	1.2	U
DHP-S03-05	8/31/1994	19 - 22	24	U
M03-04	12/15/1994	3 - 11	1.1	J
M03-04	2/7/1995	3 - 11	5.9	UJ
M03-04	6/9/1995	3 - 11	**30.9**	
M03-04	8/4/1995	3 - 11	19.6	
M03-04	11/3/1997	3 - 11	3.7	UJ
M03-04	2/10/1998	3 - 11	6.6	
M03-04	5/11/1998	3 - 11	21.2	
M03-04	8/4/1998	3 - 11	16.3	
M03-04	6/20/2002	3 - 11	**58**	
M03-04	12/10/2002	3 - 11	21	
M03-07	12/15/1994	3 - 13	7.9	
M03-07	2/8/1995	3 - 13	1	U
M03-07	6/6/1995	3 - 13	1.3	U
M03-07	8/2/1995	3 - 13	1.1	U
M03-07	11/3/1997	3 - 13	0.65	UJ
M03-07	2/6/1998	3 - 13	2.8	UJ
M03-07	5/11/1998	3 - 13	3.4	UJ
M03-07	6/21/2002	3 - 13	0.98	J
M03-07	12/11/2002	3 - 13	1.4	
M03-08A	12/9/1994	3 - 13	20	U
M03-08A	2/9/1995	3 - 13	1	U
M03-08A	6/6/1995	3 - 13	3.9	U
M03-08A	8/4/1995	3 - 13	2.2	U
M03-09	9/6/2002	21 - 33	0.27	U
M03-09	12/13/2002	21 - 33	0.67	
MW97-1	8/30/1990	5 - 15	50	U
MW97-1	10/14/1994	5 - 15	3	U
MW97-1	2/7/1995	5 - 15	1	U
MW97-1	6/8/1995	5 - 15	1.3	U
MW97-1	7/31/1995	5 - 15	1.1	U
MW97-2	8/31/1990	5 - 15	50	U
MW97-2	10/18/1994	5 - 15	7.5	U
MW97-2	2/8/1995	5 - 15	2	U
MW97-2	6/6/1995	5 - 15	2.6	U
MW97-2	8/1/1995	5 - 15	3.3	U
MW97-3	10/18/1990	5 - 15	50	U
MW97-3	10/14/1994	5 - 15	1.5	U
MW97-3	2/7/1995	5 - 15	1.1	UJ
MW97-3	6/9/1995	5 - 15	1.3	U
MW97-3	8/2/1995	5 - 15	1.1	U
MW97-3	7/3/2002	5 - 15	0.023	UJ
MW97-3	9/6/2002	5 - 15	0.12	U
MW97-3	12/10/2002	5 - 15	0.24	U
S03-DGS-DP09	6/18/2001	4.5 - 5	**133**	
S03-DGS-DP12	6/19/2001	6 - 6.5	4.2	
S03-DGS-DP14	8/2/2001	3.5 - 5	**210**	
S03-DGS-DP16	5/10/2002	6 - 8	**67.5**	
S03-DGS-DP17	4/23/2002	6	**207**	
S03-DGS-DP18	4/23/2002	6	0.65	U
S03-DGS-DP19	8/2/2001	4.5 - 6.5	**32.3**	
S03-DGS-DP31	9/24/2001	6.5 - 7	**179**	
S03-DGS-DP32	9/24/2001	7.5 - 8	3.7	UJ
S03-DGS-DP33	9/24/2001	6.5 - 7	8.9	UJ
S03-DGS-DP34	9/24/2001	6.5 - 7	8.4	UJ
S03-DGS-DP36	11/6/2001	6.5	0.78	U
S03-DGS-DP37	11/6/2001	6.5	**87**	
S03-DGS-DP38	2/8/2002	6	0.69	UJ
S03-DGS-DP39	2/8/2002	6	1.9	UJ
S03-DGS-DP41	4/23/2002	6	1.7	UJ

SAMPLING LOCATION
Red = Exceeds Screening Level[2]

- Direct-Push
- Monitoring Well
- Soil Boring

UNDERGROUND STORAGE TANK (UST)

- Present
- Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

LEAD PLUME[3]

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL BOUNDARY AND NUMBER

LAND COVER

BUILDING

- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
GAP = Generator accumulation point
J = Estimated
NADEP = Naval Aviation Depot Alameda
NAS = Naval Air Station
U = Not detected
Buildings 119-1, 120-1, 121-1, 121-1 Partial, 122-1, 123-2, 295 and 394 could not be located and are not included on this figure.

[1] Bold denotes "exceeds screening level."
[2] Screening level based on maximum ambient concentration of 28.4 µg/L.
[3] Approximate extent of lead in groundwater over background. Dashed line is an inferred boundary.

50 0 50 100 Feet

N

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Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 5-22
SITE 3 CONCENTRATIONS OF LEAD IN GROUNDWATER

Operable Unit 2B
Remedial Investigation Report